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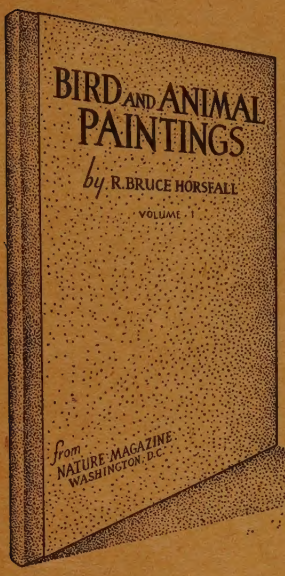

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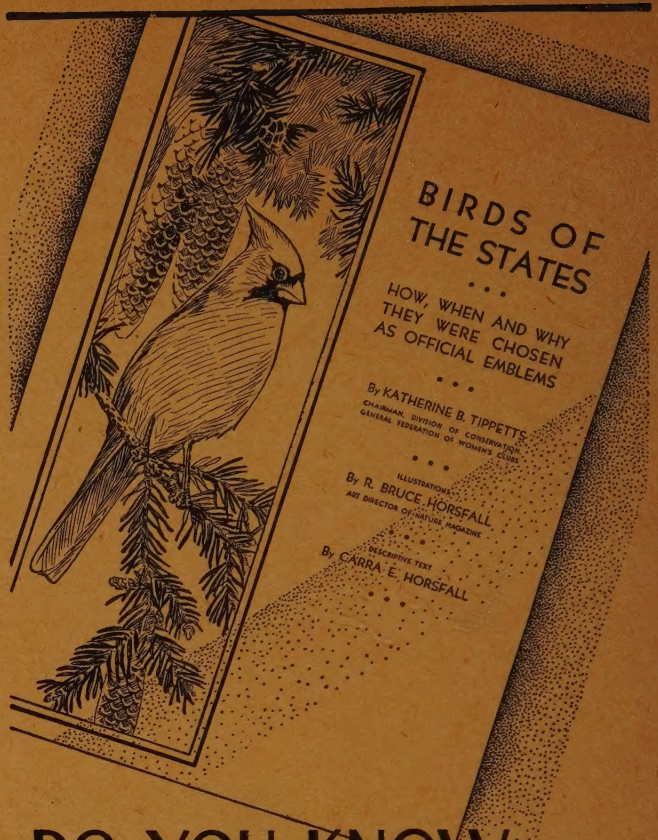
BIRDS OF THE STATES
HOW, WHEN AND WHY THEY WERE CHOSEN AS OFFICIAL EMBLEMS
By KATHERINE B. TIPPETTS
CHAIRMAN, DIVISION OF CONSERVATION GENERAL FEDERATION OF WOMEN'S CLUBS
ILLUSTRATIONS By R. BRUCE HORSFALL
ART DIRECTOR OF NATURE MAGAZINE
DESCRIPTIVE TEXT By CARRA E. HORSFALL

DO YOU KNOW The Bird of Your State?

or of the 42 other states that have adopted official birds?

The movement to select an official bird emblem for every state only recently was launched as a nation-wide movement. Some of course had adopted official birds earlier. Altogether, 43 states have now selected a bird to represent them as an emblem.

The fascinating story of how, when and why the various states selected the birds to represent them is told in this book by Katherine B. Tippetts, former Chairman of Conservation, General Federation of Women's Clubs. Illustrating the book are 30 full color paintings of the various birds by R. Bruce Horsfall, the famous wild life painter, with descriptive text by Carra E. Horsfall.

Every home and every school should have this book. It is a fascinating bit of history combined with an authentic and interesting survey of the birds of America. A handy table in the front lists the birds together with the official flowers of the states.

The 16-page book, with 30 illustrations, is offered to readers of Nature Magazine at 25 cents a copy. On orders for ten or more copies, the price is 10 cents a copy.

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Camera Trails

BY NORRIS W. HARKNESS

The Vacation Pictures

If, when the last two weeks of June came along, you started your vacation by simply getting on a train and going wherever it took you, without plan of where you wanted to go or what you wished to do after you arrived, the vacation would probably be quite a hodge-podge, and as a relief from the work of the year it would do you little good. But is that not about the way most of us make our vacation pictures?

We take along our cameras, like tickets for the trip, and carry a bag of accessories and extra film, like our suitcases and hat bags, but on this imaginary unplanned vacation, they are not apt to help us very much.

We know all that, and never fail to spend untold hours over maps and travel folders and hotel catalogs planning the whole time in as minute detail as possible, and we have a grand time. But our photography gets little attention until we are on the spot, despite the fact that it is that same camera that is going to bring back the trip more vividly later on than can anything else. The pictures we make throughout the vacation will keep it alive better and enable us to describe the places we visited more accurately to those who stayed at home—provided they are good pictures. If they are nothing more than hurried spasmodic snapshots, we might better buy all the postcards and forget about the camera entirely.

But if we try to plan the picture side of the vacation a little more accurately and to determine the kind of camera record we want to make of the two weeks, we will come back with the kind of pictures that will make the vacation remain alive long after the sunburn has faded and the moths have eaten the bathing suit.

The first thing to be decided is what equipment to take with us. Too often that means that we carry it all, and we rarely need more than the minimum. The camera, a medium yellow or yellow-green filter, the meter if we have one, a lens hood, and a supply of our favorite film will do for practically every type of picture. If we add a light tripod for the longer exposures, we will be ready for anything.

Be sure the camera and filters are clean and slip a package of lens tissue into the carrying case. Neckties and skirt hems make poor lens cleaners. And get a wrist strap that screws into the tripod socket of the camera so that it can be carried safely and easily while the meter, filters and films remain in the camera's case slung over a shoulder.

In planning the pictures, remember that there are at least two kinds of shots that you will want to make regularly. In a few instances they will overlap, but most of the time the pure record of where you went and what you did there will not be especially valuable as pictorial material, and, when you get back home, you will want both the detailed record and the more elaborate pictures for possible framing.

AN EXAMPLE OF A SCENIC PICTURE WITH A HUMAN FORM IN THE FOREGROUND TO GIVE DEPTH TO THE PHOTOGRAPH

The record shots will usually show members of the family at this or that interesting place, with the accent on the people, but the same scene may also be treated pictorially by making the place more important and subordinating the individuals to their setting. Frequently the principal difference will be the distance of the familiar faces from the camera. If they are near, the place becomes the background, but if they are placed farther away and deeper in the picture, then they only add interest to the scene and express the photographer's timing. A church is just another building if we photograph it with no humans in sight, but the interest of the picture is greatly increased if we see two or three people entering it entirely unconscious of the camera.

That the subject ignore the photographer is important in any kind of picture. If it is a landscape with the humans added near the camera to give extra depth to the shot, we will be interested in whatever they are looking at. If they are looking at the scenery, those who see the print will wonder what interested them and they will look too, but if they are looking at the camera, then no observer will bother to study the scene at all. The fact that those in the picture area did not care to look at the landscape around them will discourage all those who have only the picture before them. It is a good rule never to make an exposure while a single eye is aimed at the lens.

In making any landscape, it is a good plan to include some object fairly close to the camera. This is especially true of those exposures made from the top of cliffs and from the edges of lakes and rivers. The foreground will give a feeling of stability to the print and show the observer where he is standing to look at it. We often see pictures that make the observer wonder whether he is standing knee-deep in the water or sitting in a canoe, and the almost unconscious wondering will distract him from the picture itself. Include a bit of grass or a tree at one edge of the picture area and make him more comfortable.

But, getting back to the eyes for a moment, be careful to make your portraits seem unposed. Have your subjects pose all they please and have them act out the part they will play for the shot, but then make the exposure when they are looking away from the camera and, if possible, when they are not expecting it. Most non-professional models have a tendency to look camera-conscious and almost like stuffed figures when before the lens, and the photographer must often use subterfuge to make them look natural.

Keep in mind the vital importance of side lighting in all kinds of pictures. It avoids squinting in portraits and gives far more depth to any picture. Remember that objects can never seem to stand separated and at different distances from the camera unless the light can and does pass between them.

But to be better able to concentrate on the picture itself try to work out a definite schedule of camera operation that will reduce camera technique to the minimum. Try something like this.

With films whose speed is that of Verichrome (in most of the United States) set the diaphragm between f/8 and f/11, the shutter at 1/50th second, and the focusing scale at twenty feet. F/8 will do well with average scenes even with the medium yellow filter. Then make it a habit to wind the film immediately after each shot, and go on and make pictures.

The combination of diaphragm and focusing distance will make everything sharp from

six or eight feet from the camera to the horizon and the exposures will be all right for ninety per cent of the pictures you will want. In the higher mountain country, less exposure will do and extremely dark subjects in shady places may need more, but these camera settings will make most pictures. And having the technical details settled beforehand will let you think only of the picture.

So plan your vacation pictures as you do the trip itself. The government authorities have promised no restrictions—except those on tires and gasoline—on this summer's travel, and they plan no immediate reduction of photographic supplies before autumn at least. Your camera can be one of the best companions on your trip if you will help it. Take it along and use it—but use it carefully for the double purpose of avoiding wasted materials and of getting all the pictures you shoot.

The Problem Corner

F. E. C., Mt. Vernon, New York, says: "I have been using a very light yellow filter with Panatomic-X film and getting good results. To make the skies darker, I bought a deeper yellow filter, but the results are almost exactly like those with the light one. What causes this?"

ANS.—You do not state what filter factor you allow for the new filter but the chances are that you are over-exposing the negatives you make with it. A light yellow filter like the Eastman K-1 will yield as dark skies with no extra exposure as a medium yellow will when the exposure is made four times as great. Try a series of exposures with the new filter on the lens. Try the normal, as you calculate it, for no filter, a second one stop larger, and a third two stops larger. Then print all three negatives until the central object—not the sky—is the same tone in each and see the difference. Probably the best results will be obtained with a factor of a little less than 2.

All filters have less effect as the exposure is increased beyond the normal plus the extra required for shadow detail.

J. L. K., Reno, Nevada, asks: "How can I make pictures of small objects with no shadows against a perfectly white background without retouching the negatives?"

ANS.—You might make use of a trick that has been in use in commercial studios for years. Place the object on a piece of glass and then photograph it as usual with lights in the regular arrangement that the picture may require. Then, without moving either the camera or the object, make another exposure on another film but with all the illumination from the back of the object. Develop this masking negative to rather more than normal contrast and bind the two negatives together for printing. The first negative will make the picture and the second will be transparent in the object area but nearly opaque around it. The two in register will do the job perfectly. It is a very old trick but it still works.

C. G. K., Greensville, Virginia, asks: "Is there any advantage in using a short focus lens in my enlarger when I want to make a big print from a small part of the negative —and will the print quality be improved?"

ANS:—With both lenses of the same corrections and optical quality, the only difference will be a bigger print with the same paper-lens distance, and, because of that shorter distance from the easel to the lens, a decreased exposure time. That is based, of course, on the supposition that the negative area to be used has a diagonal no longer than the focal length of the lens. In general it is best to use in the enlarger a lens whose focal length about equals that used in the camera.

T. D., Bellows Falls, New York, asks: "Why do my more expert friends all advise the use of a tripod even for shots as short as 1/25th second? My pictures made at that speed all look sharp."

ANS.—To learn why, try twin exposures of the same subject. Make one with the camera hand-held and the other with it on a firm support and then enlarge both to perhaps eight by ten and study them carefully. It is almost certain that the supported exposure will be more crisp and clean with better detail everywhere. For most of us, it is better to make all exposures longer than 1/50th with a support.

S. W. O., Franklin, Illinois, asks a question we would all like to be able to answer more surely: "What quick method is there to learn to make good pictures?"

ANS.—Study with a good teacher, use the same camera, the same film, the same developer, the same paper and the same technique until you master them all. Then make plenty of pictures and try never to repeat the same error. It may not be a fast method, but it is as fast as any, and it is sure.

This and That

An opportunity for amateur photographers to help the men in uniform is offered to you by the Citizens' Committee for the Army and Navy, which has set up a Photographic Exhibit Committee to supply shows of photographs for the various recreation rooms in the camps. As soon as the prints are received, the committee sends them to the Morale Officers in the various encampments and these officers take care of their hanging and frequent transfer from room to room.

As this is written more than 2000 prints have been collected from photographers all over the country and distributed to the camps, but this is only a small part of the number needed. The Atlantic coast camps and the overseas bases alone will require some 30,000 prints—prints from the amateurs and professionals of the entire United States.

And this is your opportunity to use your camera to help the men in the armed forces. Send your prints to the committee at the address below. Make them eight by ten inches or larger and mount them if you wish, but send them as soon as possible to the Photographic Exhibit Committee of the Citizens' Committee for the Army and Navy, at 36 East 36th Street, New York City. The men far away from home will value them.

Before setting out on that vacation trip, take a few minutes to clean the movie camera thoroughly. Grit on the gate or almost anywhere else in the mechanism will scratch the film in long, unpleasant lines that spoil the effect on the screen. Use a soft brush and a rubber ear syringe to blow out all the dust and do not stop until the whole camera is as clean as you can get it.

Do not forget to try Kodacolor, Eastman's

(Continued on page 285)

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IN THIS ISSUE

Camera Trails.....Norris W. Harkness 282

Nature in Print.....Howard Zahniser 287

Seven Sinews of Strategy..Eugene W. Nelson 289

Would *You* Starve?.....Claire Norton 295

Perognathus—the Pocket Mouse..G. M. Bradt 298

The Black-billed Cuckoo.....H. H. Pittman 299

Wayfaring Thoughts.....Oscar Ostlund 301

Camp Hill.....Frederic T. Bioletti 302

Our Feathery Plant Friends—The Ferns
E. Laurence Palmer 305–312

As We See It..... 313

Conservation Comment..... 314

Life-line of Flotsam.....Margaret Evans Price 315

Highways to Remember.....Andrew S. Wing 318

Lake of Doom.....Marie Lomas 321

The Large Bellwort.....Warren C. Wilson 323

A Heavenly "What-is-it?".....Isabel M. Lewis 324

The School Page.....E. Laurence Palmer 326

Under the Microscope....Julian D. Corrington 334

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CAMERA TRAILS

(Continued from page 283)

new film that makes color negatives from which they make inexpensive prints in any quantity. It is a little faster and has more latitude in handling bright highlights and dark shadows than Kodachrome, and does not need to be exposed quite as accurately. Your dealer has it.

Agfa Ansco has offered a new Centennial booklet celebrating their first 100 years of photographic manufacturing, and showing an interesting short history of photography. Write to the Service Department, Agfa Ansco, Binghamton, New York, for your free copy. Please do not forget to mention Nature Magazine.

This department is operated for the benefit of amateur photographers among Nature Magazine readers. To give them the greatest possible assistance with their photographic problems, Camera Trails conducts a question-answering service that is available to all readers. Send your questions, and any comments or suggestions you may care to make, to Norris W. Harkness, Camera Trails, Nature Magazine, 1214 Sixteenth Street, N.W., Washington, D. C. Questions of general interest will be answered in the Problem Corner as well as directly by mail.

Woodland Walkers

Three attractive vacation hikes are announced for the sixth successive season by Ernest A. Dench, director of the Woodland Trail Walkers, Ho-ho-kus, New Jersey. Each trip is seven days, the dates being July 18 to 25; August 15 to 22; September 26 to October 3. The cost of the seven days is thirty-three dollars, and the locale in each case the higher Adirondacks from the Elk Lake Camps base. Space does not permit further details but these may be obtained from Mr. Dench.

Animal Guide

Name That Animal. By Ernest C. Driver. Northampton, Massachusetts. 1942. Published by the Author at 119 Prospect St., Northampton. 527 pages. Illustrated. $5.00.

Dr. Driver, who is associate professor of Zoology at Smith College, subtitles his book "A Guide to the Identification of the Common Land and Fresh-water Animals of the United States, with special references to the area east of the Rockies." This is descriptive of the contents of the book, in which the author proceeds on the conviction that the more common animals can be identified with reasonable accuracy by any interested person willing to follow the keys given in his book. He feels that his volume is really an introduction to the detailed works of our zoologists. The field covers protozoa to mammals.

Before the final preparation for the press, Dr. Driver has tried out his keys with students and friends to develop the details that are the most practicable for field identification. While not every species or every genus is included, we know of no book that attempts to take in quite as much territory, and none that does it so successfully. It seems, in fact, that this volume occupies a hitherto rather vacant niche in zoological literature.

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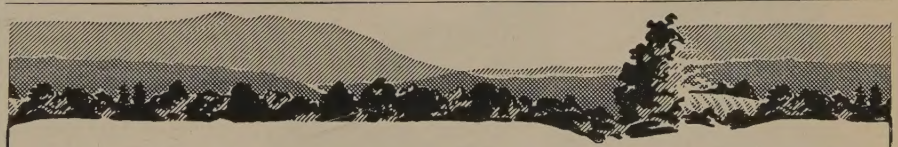

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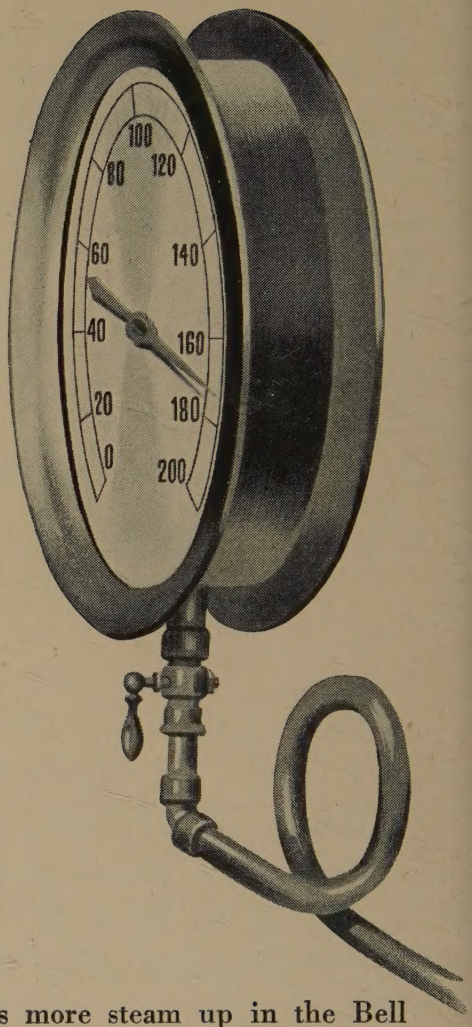

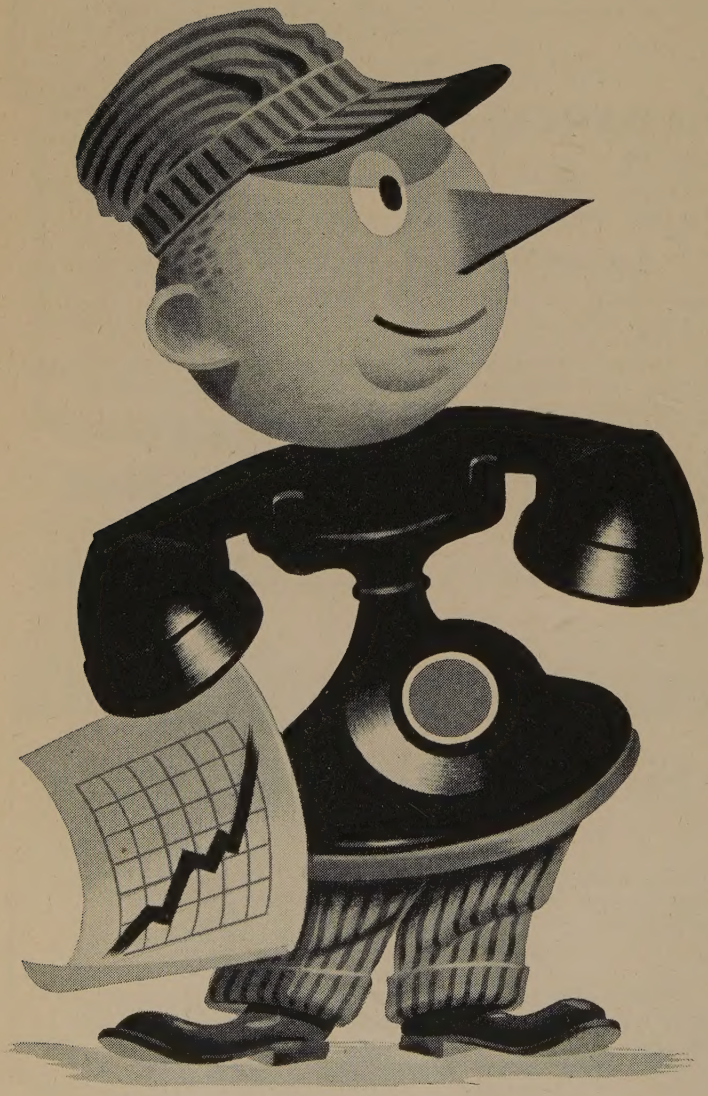

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Nature in Print

By HOWARD ZAHNISER

THIS is an article about a group of newly-published books on distant regions of the Earth that do not seem nearly so far away to us now as they would have during the very recent months when their authors were writing.* Strangely enough, the volume that creates throughout the most complete faraway atmosphere is that one which deals with the region nearest to the scene of my own reading—Arthur A. Twomey's *Needle to the North: The Story of An Expedition to Ungava and the Belcher Islands.* Richard Finnie conspires so well with the thoughts of the day regarding Canada's Northwest Territories that his purpose in writing *Canada Moves North* to describe and demonstrate the development of that region is well realized. Paul Radin's *Indians of South America* deals with a continent drawn now so close to us in many ways that the once somewhat figurative term "neighbour" has come to have a literal meaning for us. William Beebe's *Book of Bays,* covering three thousand miles of the Pacific coast from Mexico to Colombia, and even Charis Crockett's *The House in the Rain Forest,* recreating a life that she and her husband lived with the natives of New Guinea, seem to be dealing with areas that—though admittedly somewhat remote—have sacrificed to the newspapers on our porches their once strange charm of distance. Near-by Ungava itself, before these words can be read in print, may also come to have a direct presence for us. We are indeed experiencing what a pundit might call the immediacy of geography. Latitude and longitude are concepts becoming almost as immediately useful as the calendar and the clock.

Distance, however, is not the only lure of the geographer that has become more familiar. Customs and manners, once noted in other peoples with astonishment and the incredible delight that a child has in hearing its first fairy tales, no longer arouse us unduly, no matter how significant and interesting they may be. Eskimo girls chewing Arthur Twomey's dried out sealskin boots back into softness, the Madiks of New Guinea centering their lives around the ownership of certain invaluable pieces of cloth, or the Apinaye of South America subjecting their youths to elaborate initiations, are of striking interest, but so also is the fact that Gene Tunney and many other good Americans consider it important to lie on the floor fifteen minutes before breakfast and pedal an imaginary bicycle that hangs upside down between floor and ceiling. Most of us have come to believe, as Richard Finnie points out in his chapter on "Missions," that the diverse habits, beliefs, and ethics of the Earth's inhabitants have suited their followers. We are no longer shocked by their "heathen ways," but are rather willing to admit that we human beings are all creatures of the same planet with a great deal to gain from being even more catholic in our sympathies than we have already become.

It is indeed fortunate that these catholic sympathies have developed along with our sense of geographic immediacy, for otherwise the prospects for a future of peace would be much more disturbing than they are. We owe a debt to those who have made such understandings possible, and prominent among our creditors are the museums and societies that have sent expeditions to the ends of the Earth and have produced much of the literature we have on far away and long ago.

It is significant in this connection that all of these books now at hand are the results of projects thus sponsored, except that by Mr. Finnie, and his publishers point out that he is a Fellow of the Canadian Geographic Society. Mr. Twomey's experiences were gained during an expedition sent out by the Carnegie Museum of Pittsburgh for knowledge about mammals and birds. Mrs. Crockett's book is a by-product of an anthropological expedition from the Philadelphia Academy of Natural Sciences. Paul Radin's *Indians of South America* is the third volume in the Science Series of the American Museum of Natural History, and Beebe's *Book of Bays* is another in the long list of volumes that he has written about expeditions for the New York Zoological Society.

Acknowledging our debt to such institutions, we may also earnestly hope that their needs will not be overlooked when the financial arrangements for the nation's wartime economy are being made. If the private sources of their support are dried up in taxation, there should be municipal, State, or Federal revenues to supply their needs, for their services to the country are important.

We may be all the more thankful because their work has resulted not only in valuable additions to the files and literature of science but also in such excellent books for general reading. Even without the sensational lures that once characterized distant areas and differing ways of living, the authors have made these books of fascinating interest as well as timely meaning. Dr. Radin's survey of the Indian tribes of South America and their cultures, a magnificent work on anthropology, is not exactly what one would call (Continued on page 332)

*Newly published books discussed in this article are:

Needle to the North: The Story of An Expedition to Ungava and the Belcher Islands. By Arthur A. Twomey, in collaboration with Nigel Herrick. Boston: Houghton Mifflin Company. 1942. 360 pp., with 53 photographs and end-paper maps. $3.50.

Canada Moves North. By Richard Finnie. New York: The Macmillan Company. 1942. 227 pp., with 65 photographs, 1 text figure, end-paper map, list for "background reading," and index. $3.50.

The House in the Rain Forest. By Charis Crockett. Boston: Houghton Mifflin Company. 1942. 300 pp., with 28 photographs, end-paper maps, and introduction by Earnest A. Hooton. $3.

Book of Bays. By William Beebe. New York: Harcourt, Brace and Company. 1942. 302 pp., with 31 photographs, 2 drawings, text map, appendix listing published scientific articles relating to the Second *Zaca* Expedition, appendix giving scientific names for forms referred to in text, and index. $3.50.

Indians of South America. By Paul Radin. Garden City, New York: Doubleday, Doran & Company, Inc. 1942. 324 pp., with 15 photographs, end-paper map of the Indian tribes of South America, bibliography, and index. $4.

OFFICIAL U. S. NAVY PHOTOGRAPH

CHROMIUM IS A VITAL WAR METAL

In time of peace it adorns automobiles, makes modernistic furniture, and goes into a wide variety of other objects. In time of war there are many military demands, such as for use in the manufacture of sea planes, for tools and dies, and for the making of armor-piercing shells, and armor to resist shells.

NATURE MAGAZINE
VOLUME 35 · JUNE-JULY · 1942 · NUMBER 6

Antimony, chromium, manganese, mercury, nickel, tin and tungsten are the—

Seven Sinews of Strategy

By EUGENE W. NELSON

•

This is another article presenting the facts with respect to natural resources that are important to us in peacetime and vital in wartime. This article was written specially for Nature Magazine by Mr. Nelson, who is a widely known metallurgist and writer on various subjects in the field of science.

OUT OF A mother sun, in fiery agony, our world was delivered into the universe. The globe was then a mass of cosmic foam; of seething, churning billows made up of ninety-two, or more, different fundamental elements, all gaseous and flaming.

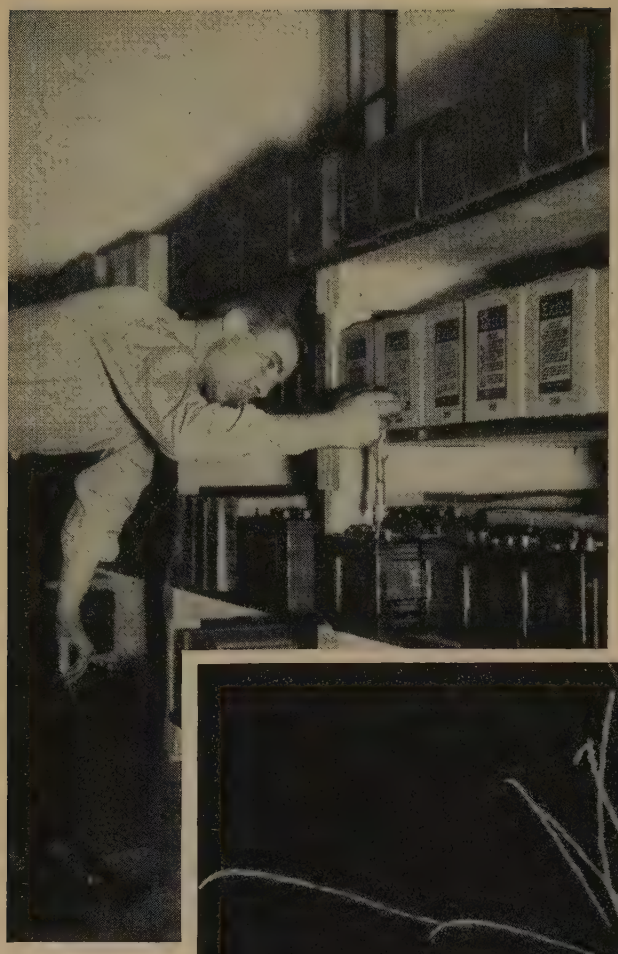
Eon-soon a protecting rocky rind formed over the earth's molten interior. Continents and seas divided. Our world began to take shape. But again and again the still-hot lands heaved amain in tortured convulsions. New mountains were thrust up and old ones were received back into earth's embrace. Molten rock and metals were spewed about the tumbling landscape, time upon time.

But ever the rocky rind that imprisons our globe's tumultuous core grew thicker and stronger. Gradually there came to be fewer of the eruptions caused by pent-up forces inside the earth. Still, those forces of molten rock and high-pressure steam remained, and even now they sometimes break through into the outer world. Volcanism we call this

NO MORE TIN FOR CANS

This strategic metal, its sources of supply seriously affected by the war in the Pacific, is essential for such war uses as tin alloy bearings in trucks for the mechanized Army.

PHOTO BY U. S. ARMY SIGNAL CORPS



ANTIMONY IN ACTION

The plates in our storage batteries depend upon the efficiency of antimony lead, and this metal also goes into bullets. Ordinarily the United States uses half the world production of antimony, but now needs much more. Most of the supply came from Chinese mines, but these rich deposits are now cut off from us.

OFFICIAL
U. S. NAVY
PHOTOGRAPH

force today, because once a small group of people living on the shores of the Mediterranean Sea thought that a god named Vulcan ruled the belching volcanoes, and was master of all the metals.

The Greeks were not so far wrong, at that. By far the majority of our earth's ore deposits are found in regions of volcanism. However, the ore deposits are related to those kinds of volcanism that occur deep beneath the earth's surface. Neither do most ore deposits lie within the volcanic rock proper, but close by in bordering rocks.

These ores were never themselves metal-rich volcanic rocks. They have been deposited where they are now found by metal-bearing solutions—extremely hot waters in which were dissolved concentrated amounts of various metals. These mineralizing solutions were squeezed from the volcanic rocks proper and into the bordering rocks. There they deposited their loads of metals.

Of course, these ores were deposited millions of years ago, and after they were laid down, any covering of earth and rocks that they had might be stripped away by erosion. After that, one of two things generally happened to the deposits. Either the *worthless* parts of the ores were dissolved by earth waters and washed away, leaving an immensely rich deposit, or the *valuable components* were dissolved and either scattered hopelessly or re-deposited deeper in the ground.

Thus were formed the Braden copper mine in Chile; the Cripple Creek gold mine in the Colorado Rockies; the Comstock Lode at Virginia City, Nevada; the huge mass of copper at Butte, Montana; the iron deposits of Birmingham, Alabama; and others too numerous to mention.

Not only were the ores laid down millions of years ago, but countless thousands of years were required to deposit them and to re-work the deposit. From those ores have come the metals on which our modern civilization has been built, although men have been using metals for only eight or ten thousand years.

In that short period of time, tribes, empires, and whole civilizations have been raised to power, and then dashed down again into the dust, because they possessed certain sources of metals, and then lost their sources. Other nations declined because new metals and alloys ousted the older ones, and those nations could not change quickly

enough. Thus, the Egyptians who built the pyramids with copper (not bronze or iron) tools went down to defeat under the bronze swords of the invading Hyksos people from Asia. But many a bronze-weaponed army was defeated by the long iron swords and steel-tipped spears of the Hittite warriors from northern Asia Minor.

Even good and poor grades of the same metal have often decided an important issue. This was the case when the Kelts invaded Italy about 200 B.C. The Kelts were weaponed with four-foot swords of soft iron. They met Roman soldiers equipped with two-foot swords forged from stout Spanish steel. It is a matter of written record that a Keltic warrior would strike one blow and then stop and straighten his blade with his foot so that he might strike again. So many of the Kelts failed to survive to strike that second blow that their invasion was turned back from Rome.

Such examples of the importance of metals in national economy are innumerable. In olden times, of course, things were comparatively simple, for the ancient metal workers—even up to the final fall of Rome—knew only a few metals. Gold, silver, copper, tin, lead, iron, and mercury; these metals they worked. A few more those ancient smiths had as curiosities—antimony and nickel and cobalt. Their alloys were bronze, pewter, and solder.

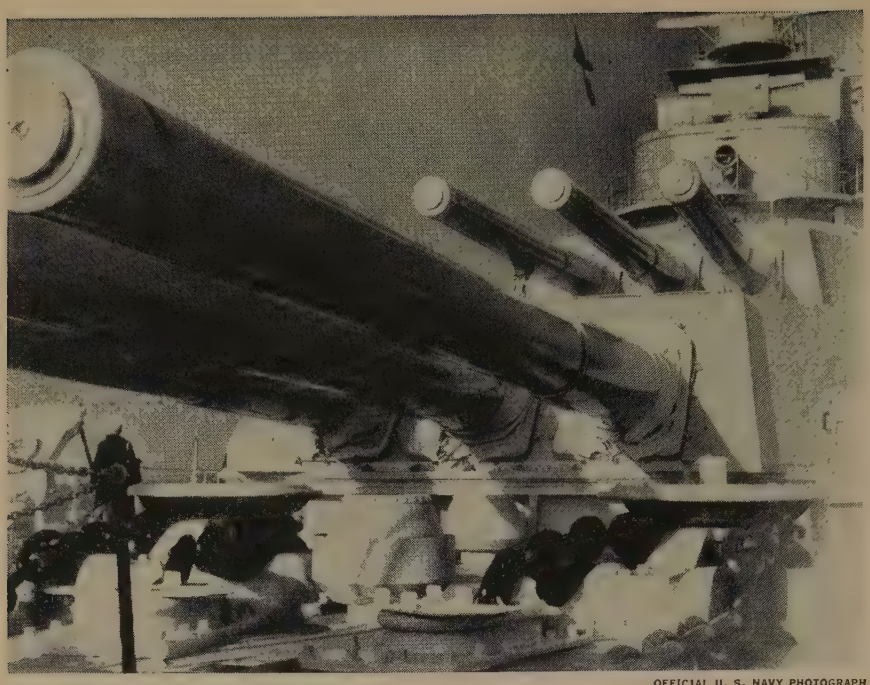
Contrast, then, that condition of almost primitive simplicity, which existed among the most highly civilized nations until well along in the Christian era, with the highly complicated conditions under which we live today. Of the ninety-two basic elements bequeathed us at the birth of our world, seventy-one are classed as metals. Modern metallurgists have actually separated them from their ores. Some of the seventy-one are present in such minute quantities that they will probably never be of importance. Others are so difficult to separate from their ores that we simply do not use them. But that still leaves about half the total number, and they are of vast importance today. They are important not so much in their pure forms as in alloys, and during the past century metallurgists have given literally thousands of different alloys to the world!

The proper functioning of the highly technical and involved civilization that modern nations have built is en-

RAZOR BLADES AND TANKS

Manganese is a metal vital in making steel and today steel production is dedicated to war purposes. There appears to be no danger that men will have to grow beards for lack of blades, but they will need to get a few extra shaves from each one so that our soldiers may not lack for the necessary tanks for modern war.

OFFICIAL U. S. MARINE CORPS PHOTOGRAPH



OFFICIAL U. S. NAVY PHOTOGRAPH

MERCURY IS ESSENTIAL

Mercury fulminate is used in the shells for the battleship guns and in bombs and other war munitions, but there is no danger of our not being able to supply it as well for clinical thermometers, since the United States has ample native supplies.

tirely dependent upon a continuous supply of a large number of metals. Our *peacetime* economy has been based upon having available at all times all the metals we use. In this, we have been singularly fortunate, since Nature has so endowed our land that the United States is by far the most self-sufficient country on earth in this respect. These vast resources have helped win for us the reputation of being the Giant of the West.

But, in the old myths, all the giants had their weaknesses. Antaeus, the Giant of Libya, could wrestle and throw anyone he chose, but as soon as he lost contact with the earth he began to lose his strength. So Hercules merely held Antaeus in the air, and then polished him off with a few well-placed rights and lefts. Even Achilles, though no giant, had his heel.

So it is with the Giant of the West—there are weak spots. In terms of metals there are seven weak sinews in the Giant's makeup. If our nation were cut off from these seven, the Giant would weaken visibly. In other words, our industrial machine would slow down towards a complete stall.

During World War I, the government coined the name "Strategic Metals" to refer to those seven. This meant that the seven metals were vitally important to modern warfare, but that, in the main, they came from overseas. Therefore, by cutting us off from them—either by conquest or successful blockade—the enemy could strike our defense activities damaging blows without ever landing a soldier on our shores. The same condition exists today.

There were two other classifications of metal made at that time. "Critical Metals" are those produced in this country in amounts insufficient for both military and civil uses, hence requiring special arrangements. The "Essential Metals" are all the rest needed for manufacturing. Let us take a comprehensive view of the entire metal situation as it exists in our land today—with emphasis on the seven strategic metals.

These seven are generally conceded to be antimony, chromium, manganese, mercury, nickel, tin and tungsten. They are arranged alphabetically on purpose. Any attempt to arrange them in order of their importance would merely start arguments. Each one is vitally important to us now, and will become increasingly so in the near future!

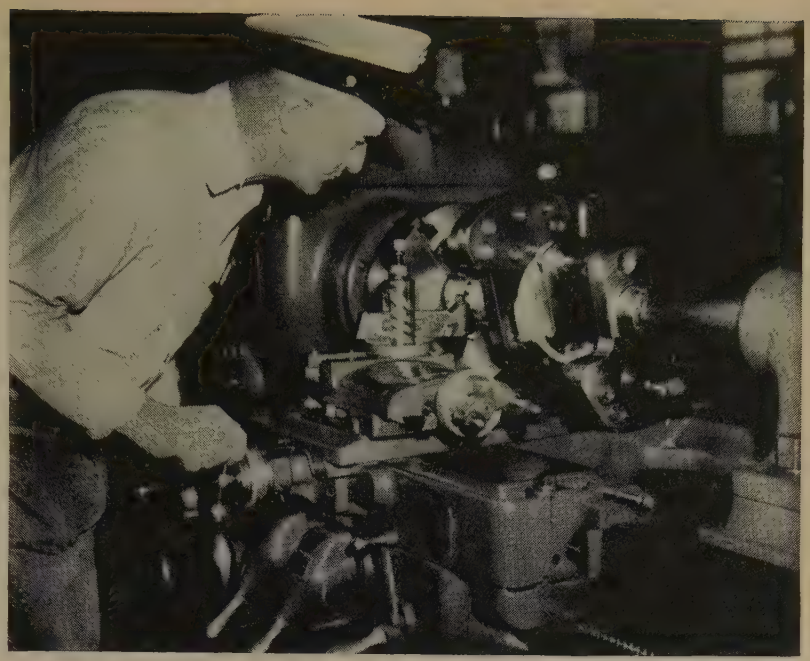
Antimony is an old metal that has never been used in large amounts in comparison with the tonnage figures for copper and iron. The ladies of the ancient

East used antimony ore for eyebrow pencils. Medieval alchemists were much taken with antimony because, when pure, this brittle silvery white metal has a surface that is studded with a pattern of fern-like "stars." Concluding that antimony was protected by lucky stars, the alchemists used it as a medicine to cure all ills.

In our modern world, antimony is used almost entirely as an alloying element and so is not very familiar to the public. In this role antimony does something no other metal can do as well—it hardens lead. Antimony-hardened lead is important for storage battery plates and electrical cable coverings. It is used in projectiles, especially for shrapnel, as it makes the lead balls keep their shape after the shell has exploded. This use alone raised antimony production from a minor to a major industry during World War I. Antimony is also indispensable in making type metal, and, to a lesser extent, in producing the metal bearings on which our mechanized forces run.

Ordinarily, we use 18,000 tons of antimony a year—about half the entire world's production. Now, we will need much more. In the past, most of this metal came to

us from Chinese mines where deposits are so large and rich that other sources could not compete. Most of this supply was cut off several years ago by Japan's blockade. Since then, Bolivia and Mexico have been sending us ample amounts, so at present we seem to be facing no shortage of the metal. Looking to the future, government engineers have spent much time and effort exploring the possibilities of two areas in Idaho and these sites *may* yield us plenty of antimony. The results are not published. However, as long as we keep our sea lanes open and maintain friendly relations with our southern neighbors, we will probably not have to worry about antimony for either civilian or military uses.



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TUNGSTEN IS IMPORTANT

We know it best in the electric light bulb, but it is vital also in industry for tools that will cut steel at high speed. Most of our supply formerly came from China but now we must develop our own supply sources.

Unlike antimony, chromium is well known because of the modernistic glamour chromium plating lends to the most prosaic articles. Chromium—its name comes from a Greek word meaning "color" since chromium compounds match all shades of the rainbow—finds its principal application in the manufacture of high-grade steels. Here, chromium becomes more important every year. Although most of us know it as a flashy fellow—chrome plate—it is actually a hard and industrious worker. Stainless steel, so valuable in aircraft, contains from fifteen to twenty-five percent of chromium. Smaller amounts of this element give steel a wonderful hardness so the metal can be used for tools and dies. Even smaller amounts—about a half of one percent—when combined with some nickel in steel, make tough, strong steel for heavy-duty axle shafts, transmission gears, and other vital parts in all kinds of machinery.

Even more than this, chromium, with nickel, imparts armor-piercing ability to shells, as well as the hardness to armor plate to resist such shells. It is also a valuable component in the high speed cutting tools used for mass production machining. Chromium's value does not end even here. It makes steel so springy that chrome steel is used for springs in heavy trucks and other vehicles. Another kind of chrome steel has such resistance to high temperatures that it is used for furnace construction.

We will need between five and six hundred thousand tons of this metal a year. Most of our chrome ore has hitherto been imported from the rich, high grade deposits in Rhodesia, South Africa. The rest came from the Philippines and Cuba. It is a long way from Rhodesia in these times. The Philippine mines may be considered lost to us for an indefinite period. Cuban ores are of low grade. What, then, shall we do for chromium?

Mining men from the United States have been attempting to develop the scattered deposits in Cuba with fair success, but not enough. The Metals Reserve Company, established to procure government-owned reserves of strategic metals, has accumulated about a half year's supply. This does not sound so good—and it is not. But little publicized mining expeditions in the past year or so have proved conclusively that we have large supplies of chromium ore in at least eight states. This ore contains a high percentage of iron and only a small amount of chromium, which ordinarily would render it useless. However, the

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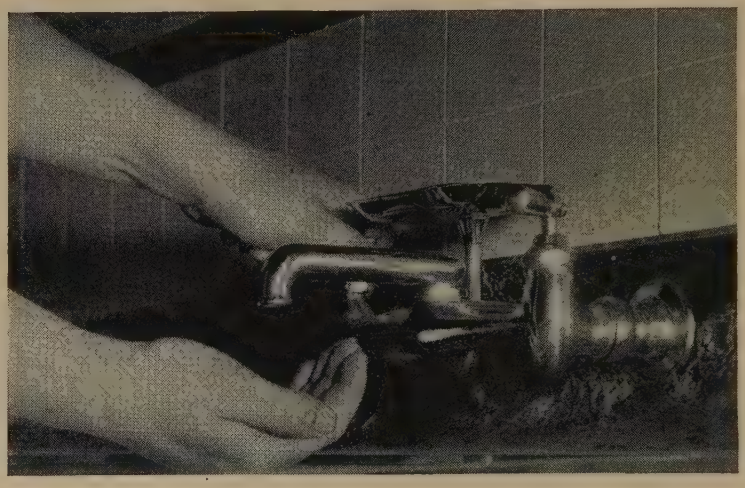
NICKEL HAS BECOME A PART OF OUR DAILY LIVES

Many are the nickel-plated gadgets in the home, and we have only to look about to see the multiplicity of its peacetime uses. In war nickel steel is essential for the production of heavy armor plate for first class battleships. This was the first use of nickel steel and was developed by a French metallurgist.



American Institute of Mining and Metallurgical Engineers reports that a new extraction method makes it possible to get chromium from these very ores, which were thought valueless a short time ago. So, as a last resort, we can get chromium from our own ores, although at a higher cost than we have paid in the past.

All this means that for an indefinite period there will be no chrome plate for civilian use. It may also mean a temporary slowing up of certain portions of our defense effort until we get our stream of chromium flowing again. The outlook is none too bright.

Manganese—its name is from the Latin word for "magnet", although this metal is *not* magnetic—is another little-known metal, since we seldom see it except in alloy form. Military men call it the "Number 1 Priority Material". This is because metallurgists simply have not learned how to make steel without manganese. In ordinary times, we need something like a million to a million and one-half tons. Of this amount we produce about forty thousand tons. Thus we use a lot more manganese than we do of the other six strategic metals.

From razor blades to battleships, manganese must enter into every object made of steel—about fourteen pounds of manganese to every ton of finished steel. And modern war is built on steel! Manganese is essential because it purges from the steel such impurities as sulphur, and disperses all air bubbles and blow holes that would otherwise form in the metal. All this increases steel's strength and hardness by making it less porous. Moreover, steel that has no manganese in it cannot be *rolled*. One can sum up the effect on steel of manganese by saying that this element gives steel the ability to "take it". It is possible that some day metallurgists will learn how to make steel without manganese. To date, this is a vague hope.

We have been importing manganese from the African Gold Coast, Russia, Brazil and the Philippines. Russia will probably need all she has for her own war effort; the Philippines need not be mentioned. Brazil has an enormous *potential* manganese production, and most of us think that Brazil is quite near. But Victoria, the nearest Brazilian port from which we can get this ore, is more than 4000 miles from Florida. That is a lot of sea lane to keep clear!

Taking all these things into consideration, various organizations in our country started stock piles of manganese some time ago. At the beginning of 1941 it was figured that we had *on hand* enough manganese to meet the maximum requirements for the next two years. A large portion of those two years is past. After that, what?

For one thing, American engineers have greatly stepped up the Cuban output. As a result of this effort, Cuba shipped us nearly a quarter of a million tons of the highest grade ore in 1941. This is three times as much as Cuba produced during its biggest year in World War I. Similar efforts are being made in Brazil and Chile. At home, the Bureau of Mines and the Geological Survey have been busy examining manganese deposits in at least ten states. They report that we have large supplies of manganese underground, but that it is of lower grade than we could economically use in peace times. However, the Bureau of Mines has perfected at least two processes for obtaining the metal from such ores, although (Continued on page 327)

If you were lost in the forest without any supply of food—

Would *You* Starve?

Illustrated by the Author

By CLAIRE NORTON

THE WIND howled down the notch of the twin peaks on our right. It shook our cold bodies, wet from the drizzle of the early afternoon. With each step our boots "skwooshed" sadly. The thick, heavy smell of rain-drenched pine needles surged up to enfold us. A timid twitter of a bird, the slight pattering of a golden aspen leaf slipping down the branches, the steady drip, drip from hat brim to shoulders were sounds caught between the throaty growls of the wind.

A shiver passed through both of us and each turned suddenly to the other. Fear started at once in two pairs of eyes. The full impact of being lost—lost and cold and hungry—hit us and gripped us. For a long moment naked panic rose out of the ashes of our adventure. Slowly the spark of fear was smothered by the blanket of sanity. Bare hands felt the roughened texture of raspberry leaves. Hats off, three fat red berries gleamed up from the black felt of mine, then three more. Soon the bottom could no longer be seen. With a voice muffled by berries, I asked, "What would you give now for a thick, juicy steak smothered in onions, or a luscious big bowl of combination salad — or even — even apple pie?"

"Why bring that up?" was the plaintive query, equally berry-muffled.

I pulled the top leaves from a nearby fireweed, just under the cottony spike that was tipped with the last magenta flowers of the season, nibbling these with an occasional wry face as we continued down toward the aspen stand and the lake beyond. Several scattered flower stalks, still bearing remnants of once grass-like leaves and topped with narrow, three-sided seed capsules, swayed back and forth in our path. We knelt and dug around these stalks with our pocket knives, turning out from a depth of two or three inches small, pear-shaped, husk-wrapped bulbs. Stripping off this outer covering, we sank our teeth into the sweet, crisp flesh of the mariposa lily.

A red glow had grown in the western sky as we rose from the damp grass. The evening breeze brushed chill against us as we hurried through the aspens to the shore of the lake. A tiny blaze was lighted and nursed into flame. The damp wood sputtered in protest, then boiled out its saturation of moisture. Flame crackled through the wood until we could feel the cheering warmth of a fire.

YELLOW POND LILY OR SPATTERDOCK
Its dried seeds furnish a tasty mush eaten like a hot cereal or sliced and fried in butter or bacon fat.

In spite of the berries and the mariposa bulbs, the empty gnawing in our stomachs increased. Stripping off our damp clothing we waded into the icy lake. Breath came in gasps as we moved deeper. Suddenly we were warmer, almost cheerful as we passed among the green lily pads, dotted here and there with the golden sparkle of an occasional late season bloom. We pulled off the ripened, globular seed pods of those that had bloomed weeks before. Returning, burdened, to our fire, we left our harvest and returned to the lake edge where we dug from the mud with our bare hands several of the matted roots of cattails.

Dressing in clothing still far from dry, we washed the mud from the cattail roots. I peeled one and ate it raw while we raked out a nest in the coals, dropped in the remaining rhizomes, covered them with coals. We left them to roast, set a flat rock in the flaming wood on the other side of the fire, piled on more wood and returned to the lake to separate the seeds from the sticky pulp of our lily pods. Back at the fire once more we dragged the hot flat stone out of the fire, piled our seeds on it and sat down to await our evening meal and to dry our boots.

Darkness settled stealthily over our immediate world, filling the spaces between the tree-clad mountains with its presence. One by one three stars appeared in the sky. Clouds left from the day sailed silently overhead. The faint silver gleam of the moon lighted up the south; peaks stood out in silhouette. The sentinel guards of tree trunks came on duty. All the night noises of the forest, the solemn "whoo" of the great owl, the gnawing of the porcupine, the snap of a twig broken by a night creature, the pit-pat and the scampering of the little animals, came to us as we scraped the burned skin from the roasted roots of cattail, crunched the parched seeds of the pond lily, and finished off with raspberries and mariposa lily bulbs for dessert.

To get oneself lost and then starve to death in any natural habitat within the confines of these United States requires a certain amount of timidity, and, to put it bluntly, stupidity. Few people will ever face such a situation. Few

ARROWHEAD, CARUM AND MARIPOSA OR SEGO LILY

The roots of all three of these served the Indian as food and are sufficiently widespread to keep the lost camper or hiker from starving. They are at their best in the spring or in the fall.

ever put themselves in a position where they might be either lost or starving. More's the pity, since they are missing the opportunity to know Nature most intimately.

I can think of no spot—desert, mountain, woods or plains—and no season, excepting perhaps the dead of winter and in a howling snowstorm, where starving would become an unavoidable tragedy. The food might not be so palatable as that even of Jake's Drive-In or Aunt Hattie's Tea Shoppe, but it would serve to keep backbone and ribs apart.

As botanists we became interested, some years ago, in primitive uses of native plant material for food. So as riders of a hobby, not as starving wayfarers, our aim has been to know at first hand the possibilities of this material.

Most of our adventures with native foods have been in the Colorado Rockies. In many instances we have added to these primitive food plants the condiments of the everyday kitchen, or cooked them by modern methods with astounding new taste sensations.

The results of these experiments give a new meaning to and feeling for common wayside plants. We can look at the lowly cattail of our roadside sloughs and say: "Lost and hungry, we still could survive as long as you are here."

Indians used, at some time, virtually all of the cattail for food, shelter, or clothing. In early spring the succulent young shoots were gathered and stewed. Later, the flowering ends contributed a kind of meal from the pollen and the ingredients for a rather flowery soup. In autumn the thick roots were dug and eaten raw or roasted, ground into meal as a part of the winter food supply, or boiled to make a syrup to sweeten favorite Indian dishes. Chemists say flour from cattail roots is highly nutritious, equal to that of corn and rice.

In late May or early June, when the upper part of the cattail mace is a full spike of golden, pollen-filled flowers, the Indians lined their canoe bottoms with blankets, paddled among the reeds and collected the golden mass of the pollen. This we, too, may do, and if we have come prepared with a sourdough base, or the "makings" for a baking-powder batter, we can enjoy a taste thrill with cattail flapjacks. This is a truly unusual but appetizing breakfast dish, with a flavor not unlike that of corn fritters.

The yellow pond lily, or spatterdock, formed an important food on the Indian's menu, both its roots and its seeds. The former were harvested by the women who waded into the pond, worked the mud away from them with their feet, then pulled the roots from the water with a hooked stick. When fully ripe in the fall these tubers are porous, glutinous, and slightly sweet, and may be boiled with wild fowl or roasted.

Seeds of the pond lily were gathered when the pods burst open, at which time they are readily washed out from the mucilaginous pulp. They were then dried and ground into meal for porridge or bread, or parched and eaten as we do popcorn. Spatterdock mush, made from the parched seeds ground between flat stones, served with cream and sugar and topped with wild raspberries, makes a worthwhile breakfast cereal. Cooked, sliced and fried in bacon drippings, it is a tasty basis for a camp supper.

Seeds of several other native plants can be similarly used, notably those of the sunflower, the evening-star flower *Mentzelia, Salvia,* blue flax, and curly dock, *Rumex.* Parched seeds of the sunflower and the *Mentzelia* are a real treat. The latter were esteemed by the Indian in whose territory they grew, and were regarded as a luxury rather than a staple food, the meal made from them being eaten in little pinches from the hand. Cooked as mush they have a pleasant aromatic flavor.

Flax seeds were much used in Indian cookery, both for their nutritive value and for the flavor they imparted to other foods with which they were cooked. Seeds of *Salvia* resemble these in properties and taste. Mush made from curly dock seeds, while not so agreeable as some others, would prevent starvation. Sunflower seeds pounded into a fine meal and added to a soup of corn and beans forms a rich, nutritious and interesting dish. Young seed pods of the yucca were boiled until tender and eaten cold, be-

MILKWEED, CATTAIL AND FIREWEED

All three of these are a valuable and healthful source of food in emergency and otherwise. The milkweed and cattail, in particular, are versatile sources of nourishment when the occasion warrants.

tween meals, but were never combined with other foods.

Early in the season there is no lack of plants that make good greens and pot herbs. The Indians knew and used many of these. Cooked as a part of a camp menu, or used in salads, they substitute for green vegetables and lettuce —both difficult to carry on an outing—and assure the camper of his vitamins for the day.

Fireweed is a widespread plant. Peoples all over the northern hemisphere have used its shoots, leaves, bark and roots. In Sweden the new shoots are eaten as a pot-herb, much as asparagus; the American Indian ate them raw. In Russia the leaves are an adulterant for tea. The tender young leaves make appetizing greens.

The foliage of dandelion, wild lettuce and mustard, lamb's quarters, common thistle and sheep sorrel serve similarly, and are particularly tender and pleasing early in the spring. The sorrel was even used in pies by the early settlers in the regions where it thrives. The tender leaves of the Rocky Mountain beeplant were cooked with fresh corn cut from the cob and highly seasoned with chile by Indians of the Southwest. Young plants of the wild sweet pea, taken when only about three inches high, were frequently cooked and eaten for greens.

Spring shoots of the marsh marigold are palatable, but being members of the buttercup family they must first be thoroughly cooked to render them harmless and wholesome. The cow parsnip, large plants of streamsides, can be safely eaten if taken when young, before the plant acquires the acrid taste that it has at maturity. In this early stage, the leaf stalks roasted over a fire and with the outer rind peeled off have a flavor rather like that of celery. In later stages of growth the plant is considered poisonous. Leaves of the monkey flower (*Mimulus*), the ubiquitous weed purslane, and watercress, are all good green salad material. Leaves of mints and related members of its family make excellent tea when steeped in hot water.

Before the white man, with his cultivated foods, the milkweed formed a staple item on the Indian's menu. The young shoots of early spring were prepared as we cook asparagus, or, together with the first tender leaves, were boiled with meat. The clusters of floral buds were next gathered and used in soups; the flowers were cut up and stewed, to be eaten as preserves. A crude sugar was also prepared from the strong-scented blossoms, by gathering them in the morning before the dew had evaporated. The young seed pods were used in soups, much as is okra, cooked with meat or even added to cornmeal mush. And in late fall the roots of some species were boiled or roasted.

Lost high above timberline, there is at least one plant upon which one could subsist until a more palatable meal was available. This is the big-rooted spring beauty, with its thick, fleshy roots, of the same family as the lower altitude spring beauty, known east and west. The crisp, nutty-flavored corms were much prized by the Indians. These may be eaten raw or boiled.

Roots of the arrowhead, carum or "yampah", mariposa lily, camas, wild blue lupine, the common thistle, pealike *Psoralea* or "Indian breadroot", balsam root, and the evening primrose have all served the Indians as food, and are sufficiently available over the country to keep the camper from starvation. They are at their best when gathered very early in the spring before the growing season, or in the fall when food has again been stored in the roots.

Roots of the arrowhead, or "wapatoo", form a nourishing meal when roasted with wild meat. Yampah, *Carum* (our caraway is of the same genus), is a tastier dish, having a distinctly nut-like flavor when raw; carroty when cooked. After the roughish, dark, outer skin is removed, the small clustered roots, looking more like misshapen peanuts than anything else, may be eaten raw, chopped or shredded and utilized in salads, boiled, or baked in hot ashes or in a pit. The lupine roots taste a bit like sweet potato when boiled or roasted.

The parsnip-like root of the thistle turns black in cooking, giving rise to its name "black-root", but it is quite toothsome; while roots of the tall-growing, yellow-flowered evening primrose, when (Continued on page 328)

Perognathus—the Pocket Mouse

By G. M. BRADT

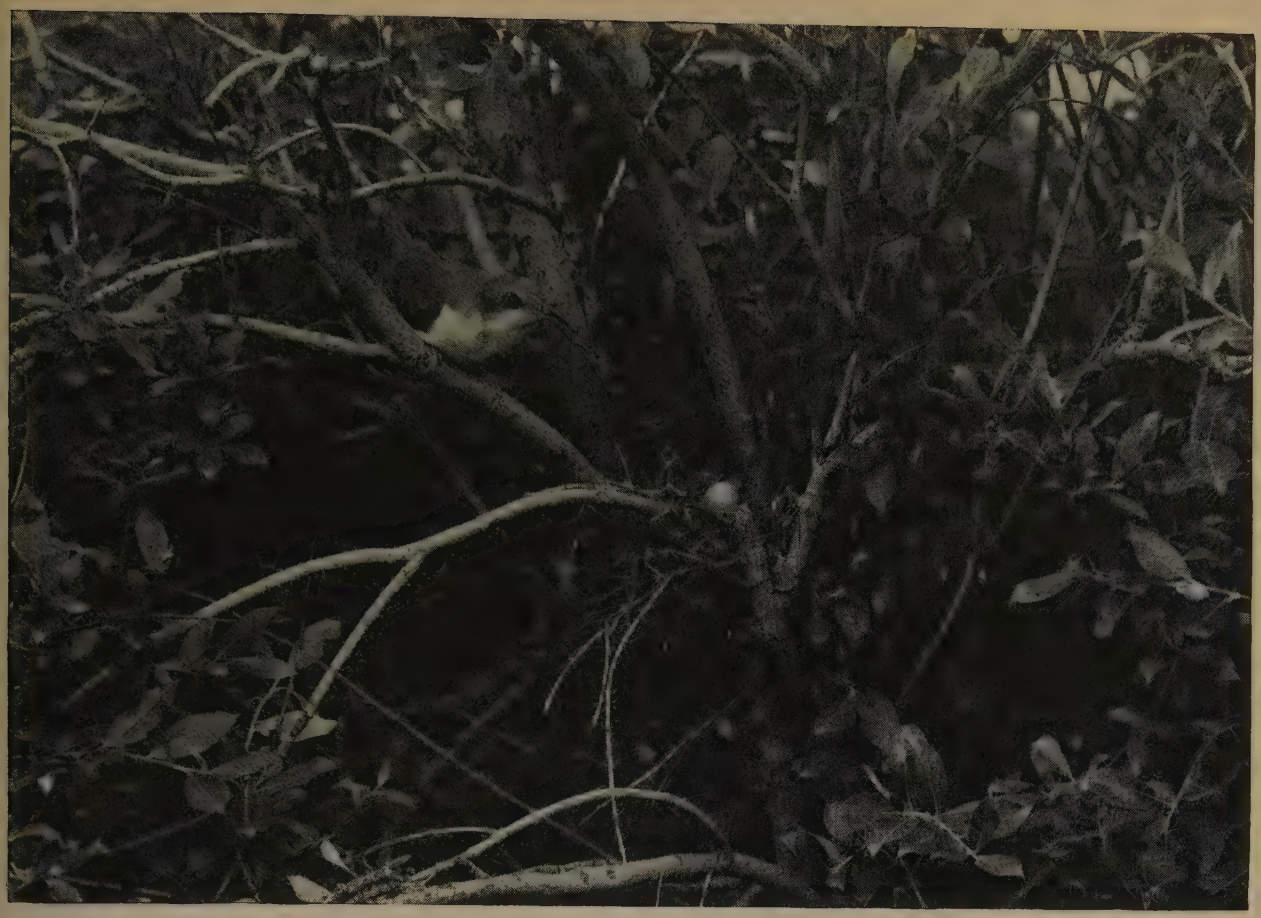
Perognathus penicillatus is a pocket mouse. It lives on the dry plains and deserts of our southwestern and mid-western states, and is a member of one of the most fascinating groups of native American rodents.

I discovered this strange little mouse living, along with wood rats, white-footed mice and kangaroo rats, on the side of one of the many limestone, fossil-bearing foothills of the Hueco Mountains of western Texas. These rodents make their homes in the minute caves and crevices so abundant in the weathered limestone. For cover they have such typical members of southwestern flora as the creosote, Mormon tea, ocotillo, yucca, countless cactuses, of which the prickly pear is the commonest species, and numerous small desert plants and grasses. Their ancient hill rises some five hundred feet above the desert flats, which themselves claim an elevation of four thousand feet above sea level.

While pocket mice may range in size from slightly less than five up to nine inches, their long hairy tails usually account for one half or more of their total length. In addition to this distinctive appendage they possess external, hair-lined cheek-pockets. With their tiny forefeet these mice stuff astonishing amounts of seeds into these handy pockets and then carry the precious food to a secret storehouse. Sleek olive-gray fur, ludicrously long whiskers, short ears and long hind feet complete the picture of these appealing little fellows.

Last October I was fortunate enough to capture a pocket mouse alive. It has been the source of unending interest and amusement ever since. A male, he measures seven inches from inquisitive nose to tip of tufted tail, with the tail itself measuring four inches. As far as his diet is concerned it has been a simple matter to feed him. He has crammed the contents of innumerable boxes of canary bird seed into bulging cheek-pockets, only to eat it all the same night. The seeds are carefully sorted by this odd creature; the black ones are piled in one corner and never eaten, the light-colored ones alone are consumed and their husks pushed through the wire front of his cage and on the kitchen floor.

Apparently he can go indefinitely without water. He was given some when first caught but as he never touched it it was removed, and he has not had a drink, nor anything but the driest seeds for three months. He sleeps all day in a nest he has built of cotton. But should anyone scratch or knock on his cage's wire facade he dashes from the cotton and up to the wire to see what is going on. He is unbelievably gentle, (Continued on page 329)



A BLACK-BILLED CUCKOO APPROACHES HER NEST IN THE DENSE THICKET

These nests are so flat that a brooding bird may sometimes knock an egg out when it is startled into making a hurried departure.

Distinctly different in many ways and in habits from its English cousin is—

The Black-billed Cuckoo

Photographs copyright by the Author

By H. H. PITTMAN

BLACK-BILLED cuckoos are so different from the birds that proclaim their name far and wide over the English countryside that it is hard for a casual observer to realize how closely they are related. The subfamily to which the American tree cuckoos belong, however, is largely a tropical one, so it is natural that the two found in western Canada should occur only along the southern border of the Dominion. They have many peculiarities of structure, plumage and voice that are generally associated with a warm, moist climate and which serve to distinguish them from any other Canadian birds. The wooded parts of the southern portion of the prairie are the northern limits of their range, and there they frequent thickets and dense shrubberies where their presence would often be unsuspected if it were not for their unusual calls.

Black-billed cuckoos are about as large as mourning doves—rather less than twelve inches in length. Their tails are long and have small white "thumb-marks" on the tips of the outer feathers. These can be made conspicuous in moments of excitement. I have always thought that the tail might form an attractive display during courtship, but the retiring habits of the birds make this difficult to watch. The throats of these birds are curiously full and rounded as though they were about to commence singing, but this is just as noticeable among the newly-feathered chicks. The head, back and tail are olive-fawn in spring, but as the summer passes the olive tint often fades, leaving a soft, dull, fawn color that contrasts pleasantly with the white throat and breast but is extremely inconspicuous against the sunshine and shadow of a leafy background.

Unless searched for, these birds are seldom seen, and it is easily possible to pass through districts where they occur without being aware of it, particularly on the northern border of their range where their distribution is local and uneven. When found, their sinuous grace in moving among the thickets, and their soft silky plumage and long tails, readily identify them as cuckoos. At close quarters it will be found that the feet are zygodactylic—two toes in

MOTHER BLACK-BILLED CUCKOO BRINGS FOOD FOR HER YOUNG

The bird below was photographed at the nest, head warily cocked with an eye for the photographer. These birds eat the hairy caterpillars shunned by many other birds and are, therefore, immensely valuable in preventing destruction of trees and shrubs.

front and two behind—and the eyes are ringed with red.

Black-billed cuckoos are insectivorous and do not reach the prairie until a liberal food-supply is assured. They are among the few birds habitually eating hairy caterpillars. Thus they help to preserve the beauty of our wooded areas by destroying troublesome larvae that few other birds will touch. The stomach lining quickly becomes coated with a somewhat felt-like covering that the birds eject at intervals, much as the owls throw up pellets of indigestible matter. A certain amount of wild fruit is eaten, and I have also been able to photograph these birds carrying grasshoppers to their young; another useful trait.

European cuckoos are parasitic and depend entirely upon other birds to hatch their eggs and rear their young, but the American cuckoos raise their own families. Their eggs have been found in other nests, but so rarely that these occurrences were probably accidental. Laying is sometimes irregular, and incubation may commence with the first laying, for I have occasionally seen eggs and chicks in the same nest.

The nests, built in late June in Saskatchewan, are rather loosely-constructed flat platforms, often with willow catkins worked into the lining, and an odd feather or two. They are generally at low elevations and I have rarely found one more than five feet from the ground. The bluish-green eggs, almost alike at both ends, vary from three to five in number, although I once saw six and have heard of seven being found. The birds may be double-brooded, for I have found eggs at the end of July in Saskatchewan.

Little newly-hatched chicks are black and curiously ugly. Whatever down they may have is scanty and soon replaced by pin-feathers with vivid blue shafts. They leave the nest unusually early—some time before they are ready to learn to fly—and perch on the surrounding branches, often remaining for a week within a few yards of their birthplace. They are difficult to find among the leaves and remain rigidly immobile with little bills pointing to the sky when alarmed, very much in the attitude adopted by disturbed bitterns. I have noticed that newly-fledged birds sometimes have a distinct patch of cinnamon-brown on the wings, a feature that I had always associated with the yellow-billed species, and a distinctive character in adults.

The flight of our cuckoos is undulating but they are rarely seen on the wing and much prefer to progress from bush to bush whenever this is possible. They arrive silently and unostentatiously in the spring, and even a careful observer

always feels that they have been present for some time before the calls are heard. They disappear in the same way and, unless a day-to-day record of birds is kept, their departure dates are hard to determine. They appear to depart from southeastern Saskatchewan about the middle of August.

The characteristic calls are a rapidly-repeated "kaow-kaow-kaow-kaow-kaow", and a pleasanter but rather more metallic one that always sounds like "coon-coon-coon-coon-coon" to me, both of which, although not loud or strident, carry for half-a-mile or more when conditions are favorable. I have heard these calls at midnight during July in southern Saskatchewan. There are several other calls—one delivered slowly and deliberately—and some liquid and musical notes and phrases that are pleasing. Occasionally these birds will mew and croak in a surprising way, particularly when alarmed about their young.

CARRYING A GRASSHOPPER

It took years of patience to get this picture showing the "thumb-marks" on the tips of the outer feathers, and the feet, with two toes in front and two behind.

I have watched and photographed black-billed cuckoos in both Manitoba and Saskatchewan, and, even where they could not be seen or heard, have traced their presence by the wrecked homes of the tent-caterpillars among the wild-rose bushes. While not plentiful in the districts I am familiar with, they appear to be steadily increasing and along the wooded banks of the Souris River and in the "park-belt" of Saskatchewan their curious calls are now often heard. Natural-history photographers may be interested to know that it took me years of work to get a picture showing the thumb-marks on the tail.

•

Wayfaring Thoughts

By OSCAR OSTLUND

While institutions go down in the upheaval of war, Nature moves forward, intact. The seasons go by in their full strength . . . the Springtime of blossom; the Summer of luxury; the Autumn of fruit.

• • •

In the uproar of systems clashing together, in the boisterous threats of powers bent on oppression, it shall strengthen free men to consider that the Lord of Hosts speaks in a "still, small voice"; that the great forces in life are working quietly.

• • •

The green leaves are silent in their immense operations as *transformers* of energy in the sun's vast power system, whence comes the food on which all life depends.

• • •

Nature declares, through its undefeatable process, that *faith* on earth shall live. Each new day confirms it and one night reveals it to the next.

The motion of Nature—the Dawn and the Sunset—our annual journey through the stars, make us sensible to the miracle of our residence, and consciousness, in space; of living in a universe that flies while it expands. What engine goes ahead? What principle motivates the core? These are secrets hid away in time.

• • •

Evidence in Nature points to the acceptableness of all change in seasons, Spring and Fall; in all the natural attributes of time . . . Youth, Age and Death.

• • •

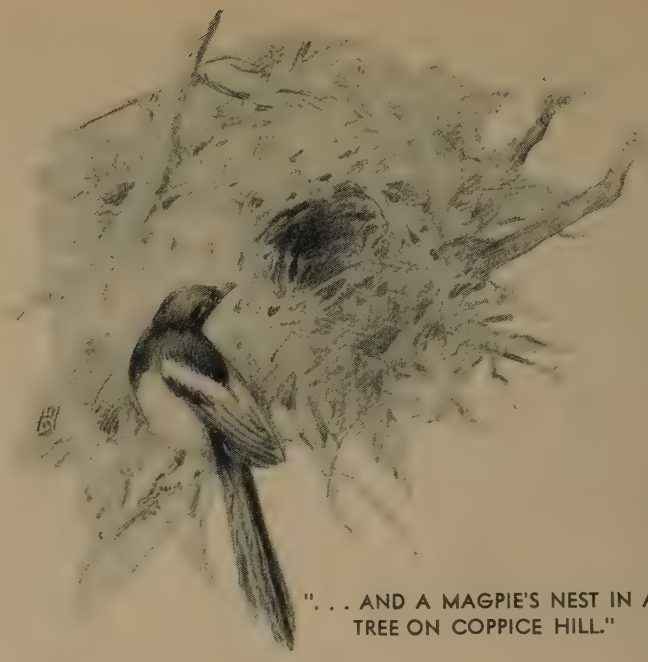
Our planet is one of nine small subdivisions out of the sun's original property. We are incorporated in its law. All forms are harnessed to its power. We are living in the suburbs of a star. The smallest individual form has a pedigree as noble as any other in this freehold.

• • •

A flowering weed speaks for the universe.

Frederic T. Bioletti passed away in 1939 after many years as a professor of viticulture at the University of California. This delightful story, found among his papers, came to us through Mr. E. B. Babcock, friend and colleague. It is a nostalgic bit, written for the benefit of his children, that demands the immortality of the printed word, not only for itself but for its record of a type of life that is probably gone forever.

Mr. Bioletti was born in Liverpool in 1865, and came to the United States in 1878. He devoted his life to the improvement of agricultural practices and conditions of rural life. He was an authority on grape varieties; by avocation a systematic botanist; author of some four hundred publications in the field of botany. A modest, retiring man, he was persistent in working for high ideals in scientific research and the application of research in industry and in rural life.



". . . AND A MAGPIE'S NEST IN A TREE ON COPPICE HILL."

The Garden of Eden was not in Armenia, or in Mesopotamia, but in Warwickshire, England, at—

CAMP HILL

Illustrated by R. Bruce Horsfall

By FREDERIC T. BIOLETTI

THE PIOUS and the learned have long disputed about the location of the Garden of Eden. Some have sought it in Armenia, others in Mesopotamia. Some have denied its existence. They are all wrong.

Your father discovered it when he was less than six years old and confirmed his discovery by numerous visits from that time until he was twelve or thirteen. Its present name is Beaudesert and it lies near Henley-in-Arden in the county of Warwickshire, and its central and most blest abode is called Camp Hill. I am going to tell you what it is like and how to get there.

You may go there at any time of the year, but the usual time is Christmas or midsummer. Your uncle buys you a ticket and puts you on the train that rushes you along through a much-divided country. Part of the country just outside the windows of the train rushes back to where you came from and the rest of it in the distance tries to keep up with you.

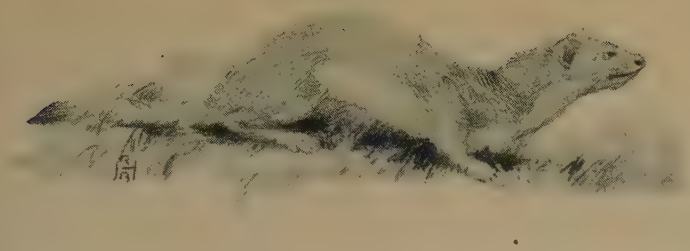
But you outspeed it all, and, if your attention is diverted for a moment by the ill-timed questions of a fellow passenger, you find that you have reached a new country. You pass vast bleak hills over which crawl great stone walls like huge worms. This, you are told, is Westmoreland. Soon you come to a more level country and pass through numerous towns. In one you see vast piles of stone bottles and empty jam pots. You enquire and learn that these are the potteries, and that ginger pop and orange marmalade are made elsewhere.

The country becomes hilly again and suddenly there appears a view so lovely that, on the first trip, you are sure it is the Paradise you have a ticket for. You are told, however, that it is only a valley in North Wales with an unpronounceable name.

Quickly you pass this lovely spot and soon reach a land of desolation. You are in the dreadful Black Country and pass through Wolverhampton of the ominous name. If it is daytime, you see blasted, leafless trees and piles of coal and cinders. If it is night, you see the red glow and belching fires of a hundred furnaces. You are not really afraid, but you know that you must be far from Paradise. It is not long before you reach Birmingham, which, though not particularly quiet nor clean, is a relief after what you have just passed through.

"THERE WAS A LITTER OF YOUNG FOXES IN THE MARL PIT . . ."

Here you alight at Snow Hill Station and are met by another uncle who takes you to the Bull Ring, where you find a large, fat innkeeper carving a huge roast



". . . YOU WOULD SOMETIMES SEE A YELLOW STOAT ON THE LAWN."

of beef for a long table of diners. After you have eaten your generous share, you are led into the courtyard and installed in the carrier's cart.

This is a large affair on wheels covered with a curved canvas roof, like a prairie schooner. It is loaded with packages and passengers—an old lady and a young lady, an old man and a young man—besides the driver and yourself.

It is night before you start, but the moon is bright and you are warmly tucked in with rugs between the ladies.

You jog along through long streets until you reach the country. Here the young man, with a fine sentimental voice, begins to sing about Juanita and mountains and moonlight. The ladies seem pleased and you are entranced. You have never heard anything so beautiful. It is a fit prelude to Camp Hill.

You stop two or three times on the way and always by a swinging sign on which is painted a Saracen's head, the name of the lighted house which lies back from the road and looks so warm and comfortable. At last, you reach the "Bird-in-Hand," where you must leave the warm rugs and pleasant company that have brought you there. You get down, not without regret, even though you know that the "Bird" stands at the bottom of the "Lane" that leads to "Camp".

"FROM HEAVEN, ON MOONBEAMS, ANGELS CAME AND BORE HER GENTLY THERE."

At the "Bird," are more uncles, some aunts, and a crowd of cousins. They have a strange, soft manner of speech, with a lack of the harsh aspirations that you have been accustomed to in the north. It is very leisurely and sweet, and is one of the proofs that at last you have reached the Garden of Eden.

After kisses and mince pie, for it is Christmas this time, you start with the uncles and aunts and in a few minutes are entering the gate of Paradise, the kitchen door of Camp Hill.

After more kisses from more aunts you look around for something that you have been thinking of on the train, in the carrier's cart, and especially in the Lane.

There it is, under the holly bush that hangs from the ceiling. It is a little over three feet high and is dressed in a white frock. It has long wavy hair and large round eyes. It is called Snow and is said to be your second sister. Whence or how or when it came is a mystery. You have been told that it was found one February night lying in the snow among the cabbages. You can hardly believe this. She must have been brought by the angels who would never have left her in such a cheerless place. But then her name is Snow, which is strong evidence. Perhaps even the snow warmed, when it saw her. Does it not nourish the snowdrops? Yes, she must be the friend of the snowdrops, whom nothing could or would harm. The real facts of the case were discovered later and recorded in verse under the title of "Snowdrop":

Soft, silent snow on Camp Hill's fields;
Calm, sleeping winter air;
From Heaven, on moonbeams, angels came
And bore her gently there;
To a nest of eider-down and fur,
On a bank where snowdrops grow.
Sleeping among her sister flowers,
They found her in the snow.

But, in any case, there she is, and offering the last irrefutable proof that you have reached the real Garden of Eden, restored and repeopled.

It would take too long to tell of all there was at Camp Hill, of all that happened, of all that lived there. But I will tell you a little.

In winter there were snow and mince pies, roast goose, and plum pudding, carol singers, and more mince pies. (Mince pies are found only during Christmas week and for every one you eat you will have a happy week—this means eight a day; more are unwholesome.) There were pippins and lady-fingers in the apple loft; mulled ale and onion soup; black-currant jam and elderberry wine in the kitchen when a little judicious coughing convinced Grandma that you were threatened with a cold. There was

". . . PAST THE DUCK POND WHICH HARBORED MYSTERIOUS NEWTS."

sometimes a goose, once even a haunch of venison, hanging on a spit in front of the hot kitchen fire, and you were allowed to turn it and even to baste it if you were careful. There were mistletoe and holly-berries, spinning the trencher, postman's knock, and ducking for apples—the list is endless. This was in winter.

In spring and summer, there were hedges of May along the lane sheltering primroses and bluebells and violets. There were harebells in the bottom meadow, cowslips in the big piece, and wild thyme on "King's Hill". There was a litter of young foxes in the marl pit, rabbit warrens and hedgehogs in the paddock, and a magpies' nest in a tree on Coppice Hill. Down in the long meadow there were mysterious corn crakes that you heard but never saw, and which you dared not seek, because there were deadly vipers there, too. There were cuckoos and nightingales, also audible but invisible, skylarks that let you see them sometimes, and the more friendly blackbirds and missel thrushes that nested in the "Shrubbery" and let you both see and hear them freely. Nothing was so beautiful as their voices, unless it was the song of the young man in the carrier's cart.

If you got out of bed very early and looked out of the window, you would sometimes see a yellow stoat on the lawn. It looked very like the ferrets that your Uncle Ted let you carry when he took you to snare rabbits in the croft. Uncle Ted was your hero and favorite companion. He often took you when he went shooting and let you carry the bag. You were only nine or ten, but he was only a few years older.

These trips included not only sport, but botany and zoology. It was after one of these trips that you made your first contribution to natural history and received the cruellest rebuff of your life. This contribution was in the form of a conundrum addressed to your favorite Aunty Beatty. "How do fieldfares resemble trees?" Answer: "By leaving in spring." This called forth the remark from your favorite Aunt: "Why Freddie, you talk like a ha'penny book." This was not meant unkindly, but as you had a subconscious impression that you were talking like the *Child's Guide to Knowledge,* which cost sixpence, it cut deeply.

At the end of the lane there ran a brook which passed the mill, the town of Henley-in-Arden, and on till it reached the River Avon. In this brook you caught minnows and gudgeons and sticklebacks, you saw speckled trout in the pools, and down in the long deep reaches above the mill, you heard of large fierce pike, for which you set night lines. This was poaching, but you were never caught, and neither were the pike.

To tell all the marvels and delights would take a year. The gathering of wild hazel nuts, the swinging on low branches of oaks, the gathering of baskets of cowslip-flowers for cowslip wine, haymaking, the swinging scythes of the mowers, all the aunties and cousins raking and tedding, carting the hay to the rickyard, the piling and thatching of hay ricks.

You took the bread and cheese and home brewed beer to the haymakers and when you got back by a short cut over the sunken fence, your Aunty Hannah gave you kissing crusts from affectionate loaves, new baked in the large brick oven, spread with her new butter or Grandma's damson jam.

In front of the house was a bank of lilies of the valley, oak stumps covered with ferns, beds of pansies, and Clarkias, and a daisy-studded lawn. There also was the only blot on the landscape, a broad gravel drive. At certain seasons, this gravel had to be weeded and your share was a piece near the kitchen window. You were kept at work by the dread of a certain thimble, which, on Grandma's finger, tapped the window if you became too much engrossed in the study of beetles or worms. Later in life you were never able to hear the sound of a hard object tapping a window pane without a feeling of intense guilt and alarm. However, even weeding had its advantages—it was always followed by tea, bread and butter, and a tart.

At one side of the house was a group of tall shady trees still called the "shrubbery". Here were elms and poplars and aspens and a swing of iron chains that had been the aeroplane of three generations.

Behind the house were sycamores and apple trees, surrounding a croquet lawn and a wonderful arbor, fashioned from an old yew. In this arbor you and your cousins filled baskets with corollas plucked from the cowslips gathered in the big-piece. Often you climbed up into the top of the arbor where the yew was pruned and trained into the likeness of a peacock with outspread tail. Here you found ripe red yew berries, which were said to be poisonous, but you knew better, for you had eaten quarts.

There were three gates leading from the enclosure around the croquet lawn. One led to the paddock, past the duck pond which harbored mysterious newts. Another led to the kitchen garden, where grew raspberries, asparagus and lettuce. Plebeian vegetables were grown at the cottage down the lane where you went to get a delicious raw turnip now and then. Through the garden you went to the apple orchard.

The third gate let past the kennel to the rickyard where you caught sparrows at night under the eaves of the ricks. Around the rickyard were the cow stalls, the stable, the coach house, and the hay barn.

In the big barn was an apple loft, very attractive in winter. Through the barnyard you went to another apple orchard and to the croft and King's Hill, where you found wild thyme, gorse, and the shepherd in his field with the lambs.

But now I must stop, for there is no end. Lanes and fields and woods were to be discovered in all directions, each with its own animals, and flowers and mysteries.

Reading from left to right and showing the fruiting parts, we see Woodsia, the blunt-lobe cliff fern; the bulb, or bladder, fern; the ostrich fern; the cinnamon fern; the waterclover fern, and the rattlesnake fern

Our Feathery Plant Friends— THE FERNS

By E. LAURENCE PALMER

Illustrated by Elizabeth Burkmeyer

This is the twentieth in Nature Magazine's series of educational inserts

SOME plant lovers may resent limiting the term "our feathered friends" to the birds. True, the ferns do not wear feathers, technically, but the fronds of many of them closely resemble feathers. And ferns have many friends and offer a worthy friendship.

Some ferns have won a place for themselves in folklore. The spores of the lady-fern, for example, are reputed to render invisible those into whose shoes they fall, or to give such persons second-sight. Shakespeare wrote: "We have the receipt of fern-seed; we walk invisible."

Such ordinarily harmless superstitions spread to the use of ferns in quack medicines. A number of ferns produce sticky substances, such as one gets by dipping the rootstocks of royal fern in hot water, and the extracts of many ferns such as polypody give a bitter taste. It is not surprising, therefore, that they found use in the days when the medicinal potency was judged by the disagreeable taste of the dose. Few, if any, of these extracts of commoner ferns find a place in modern medicine, and it may be assumed that their value was more imagined than real.

Indians and the early settlers, who lived close to the land, naturally made more use of ferns than we do. The new sprouts of the common brake and the cinnamon fern have food value and may be safely eaten. Other ferns have succulent, new, growing fronds that are tender and have some minor food value.

Cattle may eat ferns when other vegetation is not available but clear stands of many ferns in otherwise bare pasture lands testify that some, at least, are unpalatable to grazing domestic animals.

Ferns vary greatly in fragrance, as a trip through a ferny woodland, or a visit to a place where a mowing machine has cut ferns recently, will prove. Some odors may be identified with relative ease, and the hay-scented fern gets its name from the odor it produces.

Ferns are used in camp and Nature crafts. The "maidenhair" portion of the maidenhair fern is woven into baskets to give a permanent color and provide strength that may be lacking in the softer plant materials commonly used. The fine, strong rootstocks of bracken were used by Indians and early settlers in basketry and for a crude cordage.

Campers find that the dead fronds of some ferns furnish a quick fire-kindling material. This also makes a fern-covered area a place through which fire may spread with surprising speed and vigor. A camp bed laid on a springy mass of ferns is much more pleasant, physically and fragrantly, than one laid on the bare ground. Some ferns have such a fragrance that they have been used to fill pillows, but, being so fragile, ferns are quickly broken into dust.

The only real contribution that ferns make to game is to provide cover. Since many ferns do best along woodland borders, where large shelter plants are adjacent to good food plants of the fields, they probably do serve a useful function in helping small game maintain itself.

Some of the ferns have short, stocky rootstocks and do not cover much space. Others, however, may send slender under-ground shoots as much as fifty feet in a season. These serve as soil anchors. Many of the ferns help in anchoring bits of rock on the walls of gorges. They also aid the gradual weathering of rocks by root penetration of cracks and crevices.

The informed naturalist can use some of the ferns he sees to help him understand the soil on which they grow.

Reading from left to right, top row, are the narrow-leaved spleenwort; the southern lady fern; the walking fern. Middle row: the maidenhair spleenwort; the maidenhair; the brake. Lower row: the polypody; the royal fern; the interrupted fern

While many show little soil preference, others are specific in their requirements. Such ferns as the royal fern, cinnamon fern, hay-scented fern, maidenhair fern, brake, sensitive fern, lady fern, oak fern, New York fern and some of the woodferns favor soil that is slightly acid or neutral. Apparently, they do not ordinarily thrive on an alkaline soil. Such ferns as the bulblet or bladder fern, the blackstem spleenwort and some of the polypodies do better where there is a good supply of lime available. The purple cliff-brake is dependent on lime. More studies need to be made of the soil preferences of ferns.

Knowledge of the chemical needs of ferns is important to those who "just must transplant anything they find" to their backyard or to their dining room table. The chances of most ferns to survive are usually slim, but unless the soil and shade needs are recognized they have less chance. The wisest use of the beautiful things of Nature, which are food for the soul, should be taught through education.

Some ferns have a commercial value, either for sale as living plants or because of their decorative fronds. Where such demands exist, there is a powerful stimulus towards extinction.

In some regions, men make a meagre living collecting the fronds of the more sturdy ferns for the larger city florist supply houses. Since some species bear green fronds through the year, the drain is continuous.

If we must have ferns for decorative purposes, let us raise them commercially and leave the wild forms to populate the wild places. Without doubt nursery practices applied to some popular wild species would yield superior plants. This has already been done with the forms potted for household use. It should be done for ferns that have other commercial values.

Reference to the charts accompanying this article will show many seasonal fern variations. Some seem able to survive any sort of weather. Others are able to suspend development during cold or dry seasons only to renew it when suitable conditions return. This sort of behavior, if we may call it such, has led to the name resurrection fern for one of the polypodies. On the other hand, some are extremely sensitive to change and disappear quickly under adverse conditions.

With the exception of the cloverleaf fern, considered in the charts, most of the ferns here discussed follow the same general type of life history. The conspicuous part of the fern plant, as most of us know it, produces spores. These are neither male nor female. There is no significance in the common name female fern for a polypody and of male fern for the royal fern. The spores are blown by the wind or otherwise moved to a new location. If fortunate, they develop into minute, usually flat, green plants not easily seen unless grown separately. These plants are the true, sex-bearing stages of the fern plant. Male and female cells are produced on these small plants and the female cells become fertilized by the male. From the fertilized egg, develops the fern plant that we know. It, like the conspicuous part of an elm or a lily, is to the botanist a "sporophyte." In this respect, it is unlike the conspicuous part of moss which is truly sexual and is a "gametophyte."

There is something particularly significant about this sexual stage of ferns, however. It is in this stage that crosses or hybrids are produced. Ferns of some kinds do hybridize freely. This leads to the development of many plants that have the characters of at least two otherwise easily recognized species. It leads to difficulties for those who must put a name on every plant they see but makes these plants doubly interesting to those who take plant-naming seriously. The brownstem spleenwort of the genus *Asplenium* and the walking fern of the genus *Camptosorus* have been crossed artificially. According to Wherry, the resulting hybrid has produced spores that yield normal plants that have some of the characters of each parent. This being so, the cross must be regarded as an independent species.

Knowledge that this sort of thing happens in the fern may stimulate some plant lovers to experiment with other ferns to see what crosses may be produced. We have plenty of amateurs producing other new plants. Possibly, some day, we may have many producing new ferns. However, it is not as easy to cross two ferns as it is to transfer the pollen from the stamen of an iris to the pistil of another iris and then let Nature take its course. This, however, may provide the necessary challenge to some who are not satis-

fied with simple problems. Among the groups in which hybrids occur relatively commonly in Nature are the wood-ferns of the genus *Dryopteris,* and the spleenworts of the genus *Asplenium.*

These sexual stages of ferns may often be produced very simply. A flower-pot may be filled with rich earth and set in a saucer of water to remain wet. The spores are then sprinkled on the earth and the top covered with a piece of glass to keep the air sufficiently humid. They may be found rather commonly growing on the outside of flower-pots, or even on the wet bricks in green-houses. They should be kept screened from the sun. It may be a number of weeks after the spores have been sown before success is evident to the naked eye.

The commonest way for ferns to reproduce is by spreading in a number of directions over the ground, or just beneath the surface, leaving the parent stem to die and to rot. These under-ground rootstocks serve another purpose; that of food-storage. Some are short and thick; some, long and slender. Some are more or less naked; others are covered with the crowded remains of the bases of the parts that in previous years were the above-ground parts. In the lady-fern, these bases serve as food storage areas and some of them may be firm and fresh for seven or eight years after the tops that produced them have died. In part because of this, these ferns may survive even though for a year or so conditions are adverse.

The parts of the average fern above ground are, of course, important to the plant, and also important to those who would identify the plants. The plant uses the green portion above ground for the manufacture of food.

A plant like a Christmas fern, or the usual Boston fern, which is so common as a potted plant indoors, can be identified by several of the important features. The rootstock, of course, is under ground. The long "leaves" of such a fern are more properly called "fronds." In the Christmas fern, there is one main axis that extends from the rootstock to the tip of the frond. The upper portion of this axis bears a number of smaller "leaves," and this whole portion constitutes the "blade" of the frond. The main axis below the blade is the "stipe", and the axis through the blade is the "rachis." The little "leaves" that branch from the rachis are the "pinnae"; singular "pinna."

All of these simpler parts of a fern frond are important in identification. The stipe may be naked, scaly, succulent, tough, brittle, yellow, black, red, green, hairy or have other distinctive characters. What has been said of the stipe may also be said of the rachis, so the nature of these parts is worth noticing. If the plants collected are to be dried for herbarium specimens, it is well to make notes on the colors, since they will probably be lost in the dried specimen.

In many ferns the rachis may be divided into a number of branches. These smaller branches of the rachis are called the "rachillae"; singular "rachilla." The structures that correspond to the pinnae, and which spring from the rachillae, are the "pinnules", or little pinnae. And so we have these terms to remember: rootstock, blade, stipe,

Reading from left to right, top row, are the sensitive fern; the oak fern; the marsh shield fern. Middle row: the New York fern; the marginal wood fern; *Thelypteris cristata.* Lower row: the spinulose shield fern; the Christmas fern; the hay-scented fern

rachis, rachilla, pinna and pinnule. They are possibly the most important, but there are also others. The blade of a fern may be divided differently. Its parts may spread out from a common point like the fingers from the palm of the hand. In this case, the arrangement is said to be "palmate." A blade may be palmately-parted, palmately-compound or palmately-divided, depending largely on the degree of independence of the different divisions.

If the parts of a blade of a fern are divided according to the plan of the Christmas fern so that they all come from a common axis that runs down through the middle like the parts of a feather, the blade is "pinnate." We have leaves that are pinnately compound, pinnately divided and so on. Some are simply pinnate; others, twice pinnate; some, three-times pinnate, and so on. These differences should not be difficult to recognize.

In looking over the pinnae of a Christmas fern, one may notice that some of those near the tip seem to be distorted. When we first discover this, we may be inclined to think them diseased. People have been known to cut off and destroy such parts to prevent "diseased" portions contaminating "healthy" parts of the plant. As a matter of fact, these areas are perfectly healthy. They are the parts producing the spores like the one (Continued on page 312)

COMMON NAME SCIENTIFIC NAME FAMILY	RATTLESNAKE FERN *Botrychium virginianum* var. *intermedium* Family Ophioglossaceae	ROYAL FERN (1) *Osmunda regalis* var. *spectabilis* (2) Interrupted Fern, *O. claytoniana* var. *vera* (3) Cinnamon Fern, *O. cinnamomea* Family Osmundaceae	WATERCLOVER FERN *Marsilea quadrifolia* Family Marsileaceae	HAY-SCENTED FERN *Dennstaedtia punctilobula* Family Polypodiaceae
GENERAL DESCRIPTION	Height, 6 inches to 3 feet, with "stem" of single frond fleshy. Frond, in part, sterile, and part fertile. Veins of sterile part, not netted. Sterile frond, triangular, with three, obvious, much divided parts held horizontally. From the sterile frond, rises the fertile frond, often an additional foot. Frond grows from mass of thick, fleshy roots from depth of nearly one foot underground, the new frond of each year springing from the withered base of last year's frond, unfolding in its annual development.	With creeping underground stems. Height (1, 2 and 3), to 5 feet, with clustered fronds in (2), woolly when young; in (3), brown woolly. Fronds of (1), like twice-divided feather; of (2 and 3), like once-divided feather. Sterile pinnae, widely separated in (1); deeply out in (2 and 3), and with tuft of brown wool at base in (3). Rusty wool conspicuous over fronds in young of (3). Veins in the pinnae of all three, once-divided between margin and central vein which extends from base to tip.	Fronds look like parallel veined, four-leafed clovers, the parts being almost exactly equal and forming a quarter of a circle about an inch across. The rootstock is slender, tough and branching to interweave with others forming a dense mat with the assistance of rootlike branches.	Height, from 1 to 2½ feet, the fronds appearing in rows arising from slender rootstocks. Stipe or frond stem, shining brown with axes of branches pale green. Finest subdivisions, thin, paperlike, with downy hairiness and a pale yellow-green color; with appearance of being long and tapering from basal pinnae nearly 5 inches long. Fronds last through the summer, and covered with slightly sticky hairs; fragrant because of wax which they produce.
RANGE	Throughout eastern United States and southern Canada, with close relatives farther north and in the Old World. The closely related Grape-ferns of many species may extend the group still farther, some recognized species forming hybrids with others.	(1), In many parts of world; in America, from Newfoundland and Saskatchewan to South America. (2), In eastern Asia, and in eastern North America from Greenland and Manitoba to Georgia. (3), Through eastern United States and Canada, and a tropical variety.	Found largely wherever introduced, coming to America through Connecticut in 1862 and establishing itself where introduced elsewhere through northeastern United States particularly in New York, Pennsylvania, New Jersey and Maryland.	Southern highlands of Georgia to Arkansas and north to Minnesota and Nova Scotia, being commonest in poorer soils and waste places.
HABITAT	In woods, moist thickets, swamps and similar shady places where the soil tends to be neutral to slightly acid.	(1), Acid to neutral bogs, moist woods and swamps. (2), Slightly acid to neutral moist, sloping woods and open thickets. (3), Medium acid soils, in bogs, stream margins, woody hollows and swamps.	It is aquatic or nearly so and floats on still waters or establishes itself on mud flats at the edges of ponds, lakes and streams where the soil is neither acid nor alkaline.	Usually, in open dry woods or rocky slopes and only rarely in swamps. Soil preferably somewhat acid in nature. Highly sensitive to early frosts and may bleach almost white in autumn.
SPORE REPRODUCTION	Spores, bright yellow and mature in June. They develop into underground plants which bear the sex organs, and from which the more conspicuous plants arise. May be grown by raising these sexual stages from the spores, but it is too difficult a process to be attempted by the amateur. Plants may be purchased from nurserymen. Because of the depth of the root system, does not transplant well from rocky ledges.	(1), Fronds, with fertile portion at tip, with many round, yellow-brown, densely clustered spore-cases. (2), Fertile pinnae near middle of frond of 1 to 5 pairs with dense clusters of spore-cases which wither away early in season giving interrupted appearance. (3), Fertile fronds, wand-like, with green spore-cases which become cinnamon brown before withering away; spring from short rootstocks in early summer.	Fruiting bodies appear in late summer and through the winter, like small, dark, long peas or beans borne on short branches from near the base of the fronds. These are very hardy and may be dried for years only to resume growth and development when they have access to proper water and temperature.	Spores are in cases borne in a recurved toothlet of the pinnae of the fronds, with one sorus of spore-cases usually at the upper margin of each lobe. The sterile and fertile fronds are superficially much alike. The cup-like indusium bearing the spore-cases is unlike and not easily confused with similar structures in other ferns.
RELATION TO MAN, LEGENDS AND BELIEFS	This species was originally described by Linnaeus in 1753 from plants brought to him from Virginia in spite of the fact that the species grows in Europe and Asia. The Indians used the plant medicinally in the treatment of bites. Vernacular name probably from fancied resemblance of clustered sporangia to snake's rattle.	Genus *Osmunda* may refer to the Saxon god, Osmunder, or to Osmund, the Waterman reputed to have hidden his family in a clump of Royal or Regal Ferns. (2) and (3), Transplant easily and thrive in shade in house borders. (1), Also hardy when transplanted to proper soils. (1) Sometimes known as Male Fern. A mucilage extracted by hot water from the stem was used in treating coughs and diarrhœa.	The plant may have some value in anchorage of soil at the margins of waterways and it is usually more beautiful than many plants which grow in the same place. It may get out of control, however, and spread to territory where it is not wanted but at all events it provides food and some shelter for minute organisms that make their way into open water to be eaten by fish.	Discovered by Michaux in Canada. Formerly considered in genus *Dicksonia*. Possibly because of fragrant wax is not palatable to cattle and therefore multiplies extensively in suitable pasture lands. Fragrance most conspicuous in ferns grown in dry, sunny spots.

MAIDENHAIR FERN *Adiantum pedatum* Family Polypodiaceae	BRAKE. BRACKEN *Pteridium latiusculum* var. *verum* Family Polypodiaceae	BLUNT-LOBE CLIFF FERN *Woodsia obtusa* Family Polypodiaceae	(1) BRITTLE FERN *Cystopteris fragilis* (2)BULBLET OF BLADDER FERN *C. bulbifera* Family Polypodiaceae	SENSITIVE FERN *Onoclea sensibilis* var. *genuina* Family Polypodiaceae
Height of fronds, to 20 inches. Rootstocks, slender, creeping, black, wiry and producing fronds in rows. Stipe of frond, slender, tough, shining, brownish black, forked unequally to make a fan-shaped top which is held more or less horizontally. Each branch of stipe bears 5 to 9 branches which bear thin irregularly oblong pinnules which are lobed on upper margin. Whole frond is wax-coated, and sheds water. Not persistent in winter. Southern Maidenhair, *A. capillus-veneris*, has main stipe unbranched.	Height, to 3 feet, with widely spreading fronds that are twice pinnately divided from a central axis. Stipe, tough, brown, coarse, erect. Branches, twice pinnate. Blade, coarse, dull green, with the upper pinnules undivided. Rootstock, tough, the diameter of a pencil, and spreading rapidly underground, sometimes as much as 50 feet in a year and producing a row of the erect fronds above ground thus indicating its position. The fronds die back each year.	Fronds, to 3 feet long arising from very short rootstocks. The sterile and fertile fronds resemble each other in general but the sterile ones are evergreen. Unlike the Bladder Fern, it has fronds minutely hairy and scaly and the veinlets show as small markings at the lobe tips. In the sun, the fronds become yellow. The stipe and rachis are pale green to yellow with scales extending up the stipe and rachis to the glandular hairs above. Stipe, jointed above rhizome and breaks at the joint.	Fronds, from 1 foot in (1); to 4 feet long in (2); rising in clusters from usually short rootstocks but, in (2), often reclining or nearly so. The stipe is brown in (1), and pinkish in (2); the rachis green and smooth in (1), and pinkish in its lower portion in (2). The whole fronds appear to be long and tapering more particularly in (2) giving always the general appearance of being weak and brittle.	Height, to 30 inches. Sterile fronds broad, in general, rather triangular and like coarse feathers, yellowish or sometimes bluish green, with the segments near the tip not cut through to the midrib. Fronds, held more or less vertically or arching gracefully but slightly. Rootstock is shallow, much branched and sending up the fronds in rows, the sterile appearing early in the season and the fertile usually coming in the autumn.
Northern Maidenhair, from Minnesota to Nova Scotia and south to Georgia, Oklahoma and Louisiana and in Asia. Southern Maidenhair, from British Columbia to Missouri and Virginia and escaped from cultivation elsewhere.	Newfoundland to Wyoming, Arizona and Florida, being locally very common. A closely related European Bracken is *Pteris aquilina*, long thought identical with the American species. Linnaeus named the European Bracken in 1753.	From southeastern Canada, through to Alaska and south through northern United States and in the Rockies. The related Rusty Cliff-Fern, *W. ilvensis*, is found also in northern Asia and Europe.	(1), From South Dakota to Nova Scotia and North Carolina, Georgia and Arkansas in its different varieties. (2), From Newfoundland to Manitoba and south to northern Georgia and Arizona.	From Newfoundland to Saskatchewan and south to Florida and Texas with a close relative in Asia. Locally very abundant and conspicuous.
Wooded, well-drained, rich-soiled slopes, without much preference as to acidity, but doing best where the acid content is low. Should have shade. Color changes due to maturity from green to brown and red-brown.	In open woods, stream margins, banks and slopes but most commonly where it is relatively dry and where the soil is neutral or strongly acid. Its abundance does not seem to be affected by soil being neutral or acid.	Found on well-drained, shady soils, generally where the soil is neutral; often, in cracks in walls or even in sand.	(1), On slopes and ledges partly sheltered from sun; on soils usually neutral. (2), Where soil is alkaline or neutral; may appear in swamps, but usually on limestone exposures.	Swamps, wet depressions, spring-fed fields and roadsides favoring neutral soil but tolerating some acidity. Its sterile fronds do not survive a frost.
Spore-cases borne in interrupted rows of fruit-spots under the downward and inward bent tip-margin of the pinnules, the pinnule margin providing some protection as a shield and limiting slightly the direction in which the spores may be freed. The whole spore-producing section makes a series of crescent-shaped formations along outer edge of each pinnule save near tip.	The margins of the pinnules are incurved all around beneath to cover the sparsely hairy, spore-bearing areas. These fertile margins are continuous and not interrupted as in the Maidenhair and some other ferns. The fruiting areas mature in August although new fronds are being produced throughout most of the summer growing season, some of which of course do not reach maturity.	Fruiting dots are round and large and are on or below the minutely toothed lobes of the smaller parts of the fronds. They are arranged in irregular rows, usually towards the margin, and commonly terminate short veins branching from the main vein of the lobe. They mature about July and their protecting covers are lobed, spreading back to form small black stars with brown centers.	Fruiting spots, round and on the center of lateral veins that branch from the central veins on the under sides of the fronds, in (1). In (2), same general description might hold, but some pinnae bear, in their axils or lobes, small green reproductive bulblets which give the plant its common name. These are usually conspicuous in the mid- and late-summer months.	Fertile fronds produced in late summer persist through winter and produce spores in at least two years. They may persist as battered even more than two years. The spores bear chlorophyll and grow at once into the sex bearing stage. The shape of the spore-bearing parts of the fertile fronds has led to the common name of "Beadfern" which is not commonly used, however.
Easily cultivated and transplanted and for sale by gardeners. Fronds wilt quickly when cut, so are not useful for picked bouquets. Species named by Linnaeus in 1753 from plants from Canada and Virginia. Name may come from hair-like resemblance of stipe or because of use of European Venus's Hair Fern in hairwash concoctions.	The young fronds may be eaten either raw or cooked, particularly if gathered in spring when they are tender. Rootstocks used by Indians in making baskets and fronds as a thatch. Brake is not easily transplanted. Name may refer to the Greek "Pteris" meaning wing. A section of stipe is reputed to resemble the print of the devil's hoof which is probably as good as any other simile might be.	This species was originally discovered in Pennsylvania. It is a pretty fern when it is fresh and young, but becomes unsightly when mature as the fronds become blotched with white. It is at its best in June. It does not transplant well into indoor ferneries under ordinary treatment and should be left where it may have established itself naturally.	These ferns ornament many a rock exposure in gorges or hang gracefully over some woodland bank. In the hot weather of summer, the fronds of (1) turn yellow, then brown, but may recover if wet weather returns.	The fern was collected first in America in the early eighteenth century and described by Linnaeus in 1753. The American variety was named in 1937 by Edgar T. Wherry of *Nature Magazine's* Scientific Consulting Board. The common name may come from the fact that it wilts quickly when cut or touched by frost but it is hardy in other ways. It is grown relatively easily.

COMMON NAME SCIENTIFIC NAME FAMILY	OSTRICH FERN *Pteretis nodulosa* Family Polypodiaceae	(1) Northern Lady Fern *Athyrium angustum* (2) Glade Fern *A. pycnocarpum* (3) Silver-stripe Fern *A. thelypteroides* Family Polypodiaceae	(1) Maidenhair Spleenwort *Asplenium trichomanes* (2) Blackstem Spleenwort *A. resiliens* (3) Ebony or Brownstem Spleenwort *A. platyneuron* Family Polypodiaceae	WALKING FERN *Camptosorus rhizophyllus* Family Polypodiaceae
GENERAL DESCRIPTION	Height of sterile fronds, to 8 feet. Stipes, brown and scaly, with whole, sterile fronds, coarse, narrowest at base, and narrowing more gradually towards base than towards tip, in this latter respect differing from Cinnamon Fern which it otherwise slightly resembles. Rootstocks, stout, growing vertically out of ground, but bearing underground, brown, chaffy runners which reach surface at their tips and bear fronds. Sterile fronds surround fertile fronds to form a sort of vase; wither late summer	(1), to 3½ feet and (2 and 3), to 4 feet tall. Fronds, pinnate, tapering at base and tip about equally, with pinnae with entire margins in (3), but deeply toothed in (1 and 2). Stipe, yellow to red in (1 and 2), to brown in (3), and scaly below. Rootstock, short and horizontal in (1 and 2), slender in (2), producing fronds in clusters in (2), and in short rows in (1 and 3), retaining old stipe base in (1). Stipes of (1), pink with pinnae, pale green in spring, but yellow in summer.	(1 and 2), to 8 inches high; and (3), to 2 feet high. Fronds, all delicate appearing but evergreen except the erect fertile ones in (3) which are only semievergreen. The stipe and long rachis, dark brown in (1 and 3) and black in (2). The pinnae are almost opposite in (1), mostly opposite in (2), and mostly alternate in (3). They are pointed at the base in (1); "eared" in (2), and in line with the rachis in (3).	Fronds, evergreen, close to ground or only slightly raised; shaped like long, slender spearheads; tips, touching ground take root and produce clusters of similar fronds thus giving rise to common name, Walking Fern. Fronds, to nearly a foot long, though more commonly about 4 inches. Stipe, brown at base. Blades, with wavy margins; their veins form rather large areas like a net. Rich, waxy, blue-green.
RANGE	From Alaska to Newfoundland and south to northern Virginia, being much more common in the northern part of the range or at least more common in the United States along the northern border.	(1) Manitoba to Newfoundland, Virginia and Missouri. (2), Wisconsin to Maine, Georgia and Louisiana. (3), Minnesota to Nova Scotia, Missouri with variety in Asia.	(1), from Alaska to Nova Scotia and south to Georgia and Arizona. (2), from Missouri to Pennsylvania and south through Florida, Jamaica and Arizona to western South America. (3), Maine to Colorado and south to Florida and Texas.	From Minnesota to southern Quebec and south to central Georgia and eastern Oklahoma.
HABITAT	In swamps, on rubble-covered slopes, in open low-land, and wooded flats where there is an abundance of humus and where the soil is neither strongly alkaline or acid but essentially neutral.	Moist shaded woods and thickets in all species, with acid soil favored in (1 and 3) and neutral soil in (2). Generally does best in cool spots.	(1), on wet rocks and shady crevices or on dry limestone ledges or in slightly acid soil. (2), on rocks in the shade, usually in slightly alkaline soil. (3), on rocky ledges or clay, either of acid, alkaline or neutral nature.	Commonly on cliffs, and most abundant on limestone outcrops, though may grow on other rocks, in shade and even on rich humus or tree trunks. Does not normally favor acid soils.
SPORE REPRODUCTION	Spores produced on special fronds borne in the center of the year's cluster from one rootstock in late summer or autumn and looking plume-like in shape or possibly like a badly withered sterile frond; light green at first, then, dark green, then brown. The spores are not freed until spring so the fertile fronds must survive one winter and perhaps two.	Spore-bearing spots under pinnae, numerous; in (1), short, crowded and hooked; in (2), in long, regular rows; and in (3), shining, and appearing silver-striped. Spores of (1), yellow-brown. Fertile fronds less spreading than sterile in (1), and spore-bearing spots in (1), at first horseshoe-shaped, then more linear. Projections at base of stripe, good identification.	Spore-bearing spots, few, short, placed near the center along veins in (1 and 2); in (3), like short, oblong dashes starting from the midrib and extending half-way to the margin. In (3), the fertile fronds are erect and the sterile are prostrate, while in (1 and 2), the fronds are alike whether fertile or sterile.	Fruiting bodies, borne in long, slender, irregularly placed slits or streaks on the underside of the blades of the fronds, and appearing brown to blackish or rusty depending on degree of maturity reached. One of the most easily identified ferns because of these spots and the rooting habit of the frond tips.
RELATION TO MAN, LEGENDS AND BELIEFS	Described in 1803 by Michaux from a plant from Montreal but the genus was originally described by Rafinesque. The common name undoubtedly refers to the resemblance between the sterile fronds and ostrich plumes. It is one of the most beautiful ferns of its range.	One of best groups of ferns for replanting about house. (1) gets name Lady Fern from resemblance to European Lady Fern, whose spores in shoes are supposed to render wearer invisible, and also to confer on such persons second sight, useful in finding lost things, these qualities vanishing when "seed" gets lost. Indians used it medicinally to stop urine.	Beautiful little ferns that are rare and, near centers of population, are growing rarer. They do well for a time when transplanted into glass containers indoors, but usually such plants eventually get destroyed. It is better to leave the plants in their natural setting, where they are at their best.	Notable fern because of interesting way of spreading and also because it responds readily to transplanting into indoor table gardens in jars and aquaria. It can be purchased from some nurserymen and because of usual rareness should not be collected from the wild state except under favorable conditions.

CHRISTMAS FERN *Polystichum acrostichoides* Family Polypodiaceae	(1) MARGINAL WOODFERN *Dryopteris marginalis* (2) Spinulose or Toothed Woodfern. *D. spinulosa* (3) Evergreen Woodfern. *D. intermedia* (4) Giant Woodfern *D. goldiana*	NEW YORK FERN OR TAPERING FERN *Thelypteris noveboracensis* Family Polypodiaceae	OAK FERN (figured) *Phegopteris dryopteris* Family Polypodiaceae	(1) ROCKCAP FERN *Polypodium virginianum* (2) Resurrection Fern *P. polypodioides* Family Polypodiaceae
Fronds, more or less prostrate, evergreen, from 10 to 30 inches long, dark green above, and lighter beneath. Sterile fronds, shorter than those which bear spores; fertile, more erect. Fronds of the year, gray-green and unroll from crosiers or "fiddle-heads" at tips. Second growth of fronds may appear in August if preceding month has been unusually rainy. One variety has crisped or ruffled edges that make it exceptionally beautiful. Related Holly Fern *P. braunii* has blade twice pinnate.	Fronds of (1 to 3), to 30 inches tall; of (4), to 40 inches; of (1 to 3); evergreen, except that the fertile of (2) are not. Rootstocks produce fronds in clusters in (1, 3 and 4), and in short rows in (2). Stipe of (1), with shiny, brown scales; of (2), with pale brown scales; of (3), with light or dark brown scales; and of (4), with dark brown scales below, and light brown above. Alt, a dark rich green and more or less leathery in the pinnae. Family Polypodiaceae.	Height of fronds, to over 2 feet. Rootstock, slender and producing fronds in a short row. The fronds are delicate, yellow-green, thin, with the longest pinnae in the middle and forming a blade which tapers to each end conspicuously. The pinnae are hairy on the heavier veins on the under sides and the veins are mostly unbranched. The stipe is relatively short, pale green and only slightly scaly. It is slender.	Fronds, reach a height of 1½ feet, are smooth, except that the main axis may be finely fuzzy; rise in a row from rootstock; are thin, not evergreen. Stipe, pale yellow, maturing to a green brown. Blade, triangular in general outline, and in three main parts; in this respect, differing from the Long Beech-fern *P. polypodioides,* the Broad Beech-fern or Southern Beech-fern *P. hexagonoptera* which are with the pinnae connected to the main axis without separate stalks.	Fronds, to nearly a foot long, evergreen, produced in rows, from a brown, densely scaly rootstock; smooth, on both sides in (1), but grayish with fine scales, beneath in (2). The parts of the blade seem cut almost to the central axis but each part is not separated and borne on a short stem as in the Christmas Fern. The general shape of the blade may vary from triangular to oblong or even to long pointed.
From Nova Scotia to Wisconsin and south to central Florida and eastern Texas with the related Holly Fern with wider range extending to Alaska and Newfoundland.	(1), Nova Scotia to Minnesota to Alabama and Oklahoma; and in British Columbia. (2), Newfoundland to Idaho, Missouri and Virginia and in Europe and Asia. (3), Newfoundland to Wisconsin and Alabama and Mo. (4), New Brunswick to Minn. and S. C.	From Minnesota to southern Newfoundland, and to Arkansas and Georgia. The related Bog Fern, *T. simulata* extends the range to Prince Edward Island in Canada and south to Alabama. It lacks the conspicuous tapering of the blade at the base.	From Alaska to Labrador and Newfoundland, south to Virginia and in the northern parts of Europe and Asia.	From eastern Alberta to Newfoundland and south to Georgia and Arkansas, for (1), with close relatives in Europe which were long thought to be of the same species. (2), ranges from Iowa to Delaware and south into Tropical America and in South Africa.
In woods and shaded swamps and thickets or in rock crevices irrespective of whether the soil is acid, neutral or alkaline but rarely where direct sunlight strikes for any considerable period of time.	(1), favors slightly acid soil but grows in others; (2), favors slightly acid; (3), neutral to acid soils; and (4), usually in neutral soils. All favor shady slopes or swamps usually where there is good moisture.	Moist thickets, swamps and woods where the soil tends to be slightly acid. Often, grows to cover considerable areas to the exclusion of other plants.	Rocky woodlands and slopes and at the margins of swamps commonly where the soil is slightly acid but almost always where there is rather deep shade.	On dry rocky ledges, on boulder piles, on tree trunks or even on rich woodland soil varying from soils which are alkaline to those which are acid, but doing best on soils slightly acid.
The fertile fronds bear spores in spots clustered near the central line on the underside of the modified terminal pinnae. The pinnae bearing spores are usually smaller and more widely separated and set at a more acute angle with the main axis than are the sterile pinnae. The spring fronds bear spores in July and the second-growth fronds in September.	Spore-bearing spots, on undersides of pinnae, in (1), along margins; in (2), half-way between center and margin; and in (3 and 4), near center or midrib; particularly in (4), where they appear conspicuously in two rows; round in all four species, except that in (2), are more kidney-shaped; may all form hybrids with one another.	The fertile fronds appear in the summer and superficially resemble those that are sterile. The fruiting spots are on the undersides of the pinnules, are rather round and are borne just back from the margins. The protecting portion is covered with fine, glandular hairs.	The spore-bearing spots are on the underside of the pinnules arranged usually near but not at the margins and appearing more naked and exposed than many similar spots in other ferns. They are not borne on special fronds.	The spore-bearing spots are borne on the undersides of the fronds usually near the tip, are round spots which are not protected as in some other ferns. Sometimes, these spots are so crowded as to seem to be continuous. They appear midway between the midrib and margins of the part they occupy.
One of the earliest of the ferns to develop each season. The fronds, because of their graceful form, deep green color and evergreen qualities, are used considerably in decorations, particularly in funeral sprays and at Christmas. The ferns are much more beautiful and appropriate in their natural setting but have a commercial value for the cut fronds and for the living plants.	These ferns are beautiful and popular. They are hardy, and may be transplanted successfully. Their fronds unfortunately are often cut and sold for ornament but, with the more rare species such as (4), this should be prohibited.	This fern is most beautiful in its natural setting but, because of its habit of growing in rather clear stands, it is popular with those who must collect ferns for decoration for special events. The fronds are not sufficiently hardy to hold for use commercially, which is fortunate because their beauty would make them too popular for their own good.	This fern rarely grows in abundance in any one spot and lacks the lacy attractiveness of many other species. It provides a measure of beauty in dense, shaded woodlands at times of the year when other plants of the region are not conspicuous.	A decorative fern of gorges and rocky exposures; survives some exposure to sun and may be transplanted but should be left in natural setting since nurserymen supply plants more likely to survive change. Fronds curl in dry weather or in winter but recover with moisture. Known sometimes as Female Fern, and a medicine supposed to have purgative powers is extracted from the rootstock.

(Continued from page 307) from which the plant started.

These spore-bearing areas are relatively too complicated for detailed discussion in an article of this sort. They do have distinctive differences used in identification in the simplest keys. These differences are based on the shape of the spore-bearing areas, or "sori", as they are called; on their position in relation to the mid-ribs, veins and margins of the portion of the frond bearing them; on their color, and on other characteristics. In some ferns, the true spore-bearing spots are covered by a sort of shield or "indusium", which may be circular, crescent-shaped, star-shaped, or, in other species, absent. In some, this same sort of protection is effected by an incurving margin of the portion of the frond bearing the spores. This may be conspicuous or otherwise; it may be continuous or interrupted, and it may be present on some fronds and absent on others.

In some ferns, separate fronds are given over to the production of spores. In these cases these "fertile" fronds usually seem to be different from those that are "sterile." Frequently, these fertile fronds persist longer than those sterile ones; frequently they are more erect. The advantage associated with these differences should be obvious when one remembers that the spores are for the most part wind-borne and that there is enormous mortality in the spores because they may not land on suitable soil at a suitable time. Ferns that can continue to produce spores through the year thus have the greatest advantage.

Notes under walking fern and bulblet fern suggest still other ways by which some ferns reproduce.

It seems to be the style these days to study the affairs of the past whether or not the present is known. At least, many of our school children are taught more about extinct dinosaurs than they are about their living reptilian relatives. This may also be true of the ferns, since most school books give some emphasis to the giant ferns and their relatives that figured prominently in the production of coal deposits.

The true ferns have been found on the earth since Palaeozoic times. In some respects, some of the ferns representative of those earlier times were of a "higher" type than those we now find in our woods and fields. A later "insert" in this series is planned to deal with some of our present day plants more closely related to the better-known and distinctive plants of the past. For that reason, this phase of fern study will not be further elaborated. Among these modern relatives are the plants often spoken of as "fern allies." They include particularly the club mosses, the horsetails and, possibly, the quillworts.

It is not surprising that such a beautiful group of plants should be well represented in the regional Nature literature of our country. Much as the bird students have been able to get funds to publish expensive volumes on the birds of many of the different states, so, to a lesser degree, the fern lovers have been able to publish papers on the ferns of their states. Among the more useful of these are probably the following:

Native Ferns of Iowa, by I. E. Melhus, Extension Circular 225, Iowa State College, Ames, Iowa. 1936.

The Pteridophytes of West Virginia, by M. G. Brooks and A. S. Margolin, Bulletin No. 2, Series 39, West Virginia University, Morgantown, West Virginia. 1938.

The Ferns of Tennessee, by W. A. Anderson, Jr., No. 1, Volume VI, Extension Series, The University of Tennessee, Knoxville, Tennessee. 1929.

There are, of course, a number of popular books dealing with ferns. Among those that seem to be the most useful, are the following:

Guide to Eastern Ferns, by Edgar T. Wherry. The Science Press Printing Company, Lancaster, Pennsylvania. 1937.

Fieldbook of Common Ferns, by Herbert Durand. G. P. Putnam's Sons, New York City. 1928.

New England Ferns and Their Common Allies, by Helen Eastman. Houghton, Mifflin and Company, New York City. 1904.

Ferns—A Manual for the Northeastern States, by Campbell E. Waters. Henry Holt and Company, New York City. 1908.

How to Know the Ferns, by Frances Theodora Parsons. Charles Scribner's Sons, New York City. 1922.

The Fern Lover's Companion, by George H. Tilton. Little, Brown and Company, Boston, Mass. 1922.

There are, of course, excellent descriptions of ferns in most of the standard manuals of the botany of the different parts of the country. If one understands the use of technical keys and is willing to spend a little time in learning the terms used in them, these books will probably be more satisfactory than the more specialized, popular works.

There is room for a richer, newer type of literature on ferns. It should include sections on the propagation of ferns; on their medicinal uses; on their commercial value; on their soil preferences. There should be data on the conditions of humidity under which the species shed their spores; on the number of hours of direct sunlight the different species can survive. We need more literature on means of propagating ferns for use in and around our homes, and, as suggested, some hobbyists who will undertake the creation of new forms by crossing those that are now recognized as distinct species. We need more regional publications such as those listed from West Virginia, Tennessee and Iowa, and possibly we need some concerted effort, either through education or legislation, to assure the protection of the rarer species, particularly in the vicinity of larger centers of population. This might be furthered by popular manuals simple enough to be useful to park superintendents and landscape engineers, who often unintentionally create conditions that wipe out "last stands" of valuable species. Such information should be available to CCC boys and to their supervising officers, and some provision should be made to see that these persons use this information when it is available to them. In short, there are both work and opportunity for any who are or who may become interested in our feathery plant friends.

This insert is modified from the leaflet published earlier by the New York State College of Agriculture and written by the author. Permission to make this is acknowledged.

As We See It

REPORT ON BIRD PROTECTION ★ ★

Time was when the Committee on Bird Protection of the American Ornithologists' Union concluded that the status of bird life in North America had become so encouraging that it seemed useless to continue its studies. However, viewpoints change, and the report of the current Committee, announced at the 59th stated meeting at Denver, Colorado, in early September, 1941, and just made public in the April *Auk*, presents convincing proof that a number of species that used to be enormously abundant are now in need of our heartiest solicitude.

The present review merely touches certain important recommendations concerning various species that need all possible help. In most cases their ills have been caused by man's injudicious acts, and the obvious remedy is to cease the practices involved. The Committee cites instances of progress in certain directions that have resulted from the efforts of Federal agencies and several privately administered conservation organizations.

The following species or groups of birds are among those considered to be endangered. Other species considered are great white heron, roseate spoonbill, condor, crane and bald eagle. The report should be studied in its entirety by all conservationists.

WATERFOWL. The Committee is convinced that hunting is now a critical factor preventing speedy recovery of the birds. It believes that the 1940 hunting-season kill of ducks and geese was almost equal to the year's crop, that the breeding population sent back to the nesting grounds is too small for safety, that the increasing number of waterfowl hunters has almost overtaken any gains made between 1935 and 1940, and that the concessions lately made to hunters were unwise. Also, that the effect of the regulation permitting the daily take of one wood duck should be carefully watched. In this NATURE MAGAZINE concurs, having learned of flagrant violations of this injudicious regulation.

CANVAS-BACK, REDHEAD AND RUDDY. The Committee considers the return of the canvas-back and the ruddy duck to the shootable list as a grave error not justified by the facts; that the redhead is in a precarious condition, and that its similarity to the canvas-back heightens its insecurity. It states that the regulations governing hunting should be made more restrictive, pending definite further gains of the breeding stocks.

ROSS'S GOOSE. Decidedly smaller numbers of the Ross's goose were seen during December, 1940, as compared with those of the preceding year; closing the hunting season for several years on all white geese west of the Great Basin (or at least in California) is recommended. The small breeding and wintering areas invite danger.

TRUMPETER SWAN. Increase of trumpeter swans continues to be very slow, only 211 birds having been found in the United States in August, 1941.

The Committee highly commends the Federal wildlife service for closing the season on snow geese in Idaho, and recommends a similar closed season in the Montana counties adjacent to Red Rock Lakes Wildlife Refuge and Yellowstone National Park for further swan protection.

SHARP-TAILED AND PINNATED GROUSE. The Committee states that the sharp-tailed grouse is fast losing its position as a shootable game bird, and predicts a similar fate impending for the pinnated grouse. NATURE MAGAZINE believes that both species already have attained this position.

The Committee in this connection makes this observation: " 'Game-restoration' efforts in many States are concentrated on raising and liberating Ring-necked Pheasants, Hungarian Partridges and other exotic game birds. If long continued to excess, this practice may not only replace but even exterminate some of our native game birds. We believe that a larger percentage of available funds should be spent for research and for habitat improvement. More emphasis should be placed on encouraging natural propagation of native game birds."

WOODCOCK. The report reviews recent happenings affecting the woodcock population, which "has definitely and seriously slumped . . . in the eastern United States for the second successive year." It further deplores the fact that fourteen different open-season periods are provided to insure the most favorable shooting for the hunters within the bird's range, for while the hunting period in any one zone is limited to fifteen days, there is a period within the bird's range of 90 hunting days. Further restriction on the take appears to the Committee to be imperative.

WILSON'S SNIPE. In the opinion of the Committee the closed season on this bird should not be lifted until the bird's present dangerously reduced numbers are replaced by normal populations.

WHITE-WINGED DOVE. The plight of the white-winged dove is stated to have become increasingly serious, and the Committee regrets that a closed hunting season throughout was not imposed, as was recommended by the organized sportsmen of Arizona. The Committee repeats its recommendation of the year before that the Arizona Game Commission, the Texas Game, Fish and Oyster Commission, and the Fish and Wildlife Service declare a continuous closed season on the white-winged dove.

MOURNING DOVE. Much concern for the eastern mourning dove is the result of recent findings. Despite more restrictive hunting regulations the dove population is decidedly unsatisfactory and the stock should be better protected. The maximum of 42 days is considered to be much too long under the present emergency.

Conservation Comment

Sessions of the Seventh North American Wildlife Conference were held in Toronto, Canada, in early April under the sponsorship of the American Wildlife Institute. Despite the times and distance the Conference was well attended and attracted those interested in wildlife conservation from various viewpoints. The discussions of both general and technical sessions, as with the previous annual conferences, will be published completely by the Institute in its series of Transactions. The unavoidable delay and the limitations of space permit no report of the meeting, beyond the quotation of the following thoughts expressed by speakers:

"No matter how wise the laws adopted or how sound the regulations, success in wildlife management depends in the last analysis on the cooperation and understanding of the public." Charles Camsell, Deputy Minister of Mines and Resources of Canada. . . . "Consumption of wildlife will decrease during the war, while the gains that conservation has made will be largely maintained." Ira N. Gabrielson, Director of the United States Fish and Wildlife Service. . . . "Conservation is not merely a peace-time philosophy. The principles of careful use and efficient management are even more important in a nation at war." Hugh H. Bennett, Chief of the United States Soil Conservation Service. . . . "The immediate problem is to determine as accurately as possible the limiting factors which the present conflict may place upon the scientific approach to conservation and then to direct the efforts of the technicians toward the development and supervision of a biologically sound plan for the wartime use of our wildlife resources." Richard Gerstell, Pennsylvania Game Commission. . . . "Conservationists are going to have to work with fewer and less adequate tools." Lithgow Osborne, Conservation Commissioner of New York. . . . "We must be vigilant to see that the conservation base is not pulled out from under us in favor of pork barrel ideas." Kenneth A. Reed, Izaak Walton League of America. . . . "Five percent of the sportsmen feel that the purchase of a gun licenses them to ride roughshod over public and private rights. These few stamp the rest of the sportsmen in the eyes of those who do not hunt." D. J. Taylor, Deputy Administrator of Game and Fisheries, Province of Ontario. . . . "Our President has pledged to our Allies that the United States will supply munitions to the utmost that our factories and our men can produce. Duck-shooting this year can benefit only our enemies. Every ounce of our ammunition must be hurled at our enemies in defense of decency and Christendom." Mrs. C. N. Edge, Chairman of the Emergency Conservation Committee.

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Pollution control was urged, more high dams condemned, protection of shoreline timber sought, wilderness area defense demanded, and reduction of wildlife research appropriations opposed in resolutions adopted at the twentieth annual convention of the Izaak Walton League of America. On pollution the League called for adequate and appropriate action "to eradicate and control pollution hazards to public health and to the well-being of our aquatic resources accruing from increased industrialization and abnormal concentrations of population in defense areas so that the possibility of epidemics endangering our armed forces and defense workers and hampering our war effort may be entirely eliminated." Another resolution urged negotiation of an international treaty regulating fisheries in the Great Lakes. Action by the Federal Government and the states to regulate destructive timber cutting practices of privately-owned lands was also urged. A resolution opposed registration, licensing or requisitioning of personal firearms as "inimical to both personal and national security." It was contended that such action "would merely play into the hands of subversive elements by disarming the citizens."

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Duncan McDuffie, civic leader and widely-known conservationist, has been elected chairman of the Board of Directors of the Save-the-Redwoods League. He succeeds the late Joseph D. Grant who served in this post for twenty-one years. Under Mr. McDuffie's leadership the League faces the important task of saving the Avenue of the Giants in the redwoods of Humboldt County. They are now in the path of lumbering operations.

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Including planting last year, 16,104 miles of shelterbelts on 26,375 farms have been planted in the Prairie States Forestry Project. The survival rate of trees planted has been high and was 82 percent in 1941 as compared with 79 percent in 1940 and 52 percent during 1936, the worst drought year. Many of the belts planted six or seven years ago, according to the Forest Service, are already yielding fence posts and some fuel as a result of thinnings.

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Using the value of standing trees cut annually as a basis, the Dominion Forest Service of Canada places a monetary value of $1,075,000,000 on the forests of the Dominion. It is pointed out, however, that this capital value figure does not take into account many other things that add to the real value, including protection of watersheds, recreation, wildlife habitat, and soil conservation. All these, if they could be valued in dollars and cents, would probably double the value of the forests.

A MINIATURE JUNGLE OF VEGETATION BEARDS THE BOILERS

A questing hand will bring up many algae that, floated in a pan, will reveal beautiful shapes like trees or ferns or plumes, for sea plants parallel closely the forms of land growth.

Mystery and beauty lie amongst the seaweeds found in the dark sea wrack of the—

Life-line of Flotsam

Illustrated by the Author

By MARGARET EVANS PRICE

HIGH UP on the beach, dark sea wrack makes a scalloped line of definition, seeming to mark off and separate what belongs to Ocean from that which belongs to Earth. It is a shifting border, a fertile, three-dimensional one, from which life has been creeping up to cover the Earth with adapted growth, since the beginning. This line of flotsam is a life-line, teeming with plant and animal growth, and the phases in between. Almost anything that one pokes out of the tangle, and stops to investigate, can pose a question that may fill up the years ahead with mystery and beauty and the quest for an answer.

You may be tramping happily along the firm wet sand, and see a shell tangled in the kelp. You pick it up. It is a rare one, but it is imperfect. You regret the hole in it, through which a seaweed thrusts and sprouts into something like a limp little willow tree. You wonder, did the spore of the seaweed get into the shell and attach itself, after the hole was there, and proceed to grow up through it like this? Or could it have worked through the shell as the roots of a cedar tree push through rock?

You look up algae when you go home, skimming through pages of marine botany, and you find that the limp little seaweed could, and probably did, work right through the shell, regardless of the open end that had suited its first occupant. You find out, also, that some seaweeds can swim, actively, by means of cilia, or hair-like filaments. Algae have a new meaning, suddenly. They seem positive, active things, instead of part of the wrack and flotsam.

You take to swimming out at low tide around the boilers, for this is a Bermuda beach. However, any rocky Atlantic shore can yield plenty of specimens. You may have been warned about the boilers, warned against centrifugal currents and marine things with nasty stings, but the game is on once you smell the iodine from the miniature jungle of vegetation covering the crater-shaped rocks.

Good specimens of algae are most likely to be found attached, but others are parasitic, clinging to those that have been washed in from far seas—the Sargasso, the Caribbean—or hitch-hiking on ones that have come up to Bermuda's south shore, actively swimming from vast distances.

Many of the most exquisite specimens look like little swatches of wet embroidery floss when they are found, washed up among the coarser kelp, or gathered off the rocks above the low tide level. Those that are plucked beneath the surface reveal, in the limpid water, all the loveliness of the sea-rhythm that is in their motion.

Around the boilers you reach a hesitant hand down

into the clear water and gently clutch a handful of growth and bring it up, a hesitant hand because in the jungle that beards the boilers there are some organic things that are not so pleasant to touch, one, for example, that looks almost exactly like a toad, but has no legs.

You come back to shore with a good handful of very soft material, and float it in a pan of salt water to see what you have. There the specimens unfold, spread, wave their tiny, feathery leaves and sweep into shapes like trees or ferns or plumes, for the growth of sea plants parallels closely the forms of land growth.

Whatever varieties you may have found, you have beauty of design and form and color. It is by color classification that the main groups are named.

The most frequently found are the red algae, or Rhodophyceae. The brown are called Phaeophyceae, the green, Chlorophyceae, and the blue-green Cyanophyceae. This group in particular illustrates the baffling job of dividing into species, because, while all members of the Cyanophyceae do possess the blue-green coloring matter called phycocyanin, it is often subordinated to other coloring matter, and certain plants of the group can vary from the usual blue-green to yellow, brown, purple or violet.

A delicate, pale rose parasite often attaches itself to this Phaeophyceae.

The depth of the water, too, has an effect on color, so that the same species at different depths can range widely. Certain species have adapted themselves to deep water, as for instance the red algae, which can thrive at considerable depths because they are able to utilize yellow light, rather than red. Red light has not the power to penetrate as deeply as yellow. Green strikes deepest of all. But a sea plant that utilizes red light is not necessarily red, nor is the deepest-growing one green, in the green light penetration.

Red light loses its potency at a depth of a little more than a hundred feet, yellow at something over five hundred, but green holds fairly strong and vital almost a thousand feet down. So the same plant, receiving varying amounts of the light it likes best, can vary in color, and throw the amateur off the track. Again, algae of totally different species can look like iodine brothers.

Seaweeds are touchy and sensitive plants and most of them refuse to go on with their life cycle under artificial conditions, so it is difficult to get a chance to observe even the more common species from spore to spore.

At different stages of growth a specimen can have a different color and even form, and be unrecognized, or wrongly classified.

All this inclines one to be content with an aesthetic enjoyment of their beauty without getting too much bothered about feeling ignorant. The sea is full of unclassified algae. You can bolster yourself with the thought, too, that botanists do not agree, and that some thirty thousand sub-classifications, more or less, do not matter, if you can see color and please yourself with tracing form relations to land plants, for these relations are strong and apparent at once.

There is a tiny Rhodophyceae that is found washed up amid kelp and sargasso weed, or growing on rocks in shallow water, at low tide, that resembles a willow tree in structure. It has a green cousin that looks even more so, but the green cousin might, after all, be a

This is a Phaeophyceae that shades from gold to the deepest brown.

Two kinds of parasites have taken hold of this air-berried Phaeophyceae.

Two varieties of antlered Phaeophyceae, one gold-colored and one dark brown.

This variety of Phaeophyceae is a traveler, having both cilia and air-berries.

A variety of Cyanophyceae, clear blue green variegated with ivory.

This plume-like Rhodophyceae is an exquisite warm rose in coloration.

One of the Rhodophyceae that is especially rich in important iodine.

This one is a white-stemmed alga with tips of dark red or bright green.

Rhodophyceae in another stage of growth. There is much to learn.

There are some that look like miniatures of land ferns. There are palm-like branches and vine-growing plants, and there are grass-like clusters—bright green, too—and others that look exactly like wood moss, even to the little touch of reddish spore color.

Nearly all of them possess chlorophyll, and so are capable of utilizing carbonic acid gas as a source of carbon in the presence of sunlight. The floaters and hitch-hikers get the most sunlight.

The technique of mounting specimens is simple, the only trick being to keep something of their natural rhythm. So when you mount them, watch for this quality. You keep it by tipping the big, flat pan of sea water into which you drop your specimens to find out what you have. While the plant floats, moves, feathers its way across the pan, you catch it in motion by slipping under it a card of the size you wish your mounts to be.

Then, quickly, you pull the card out of the water, keeping it at an angle corresponding with the motion of the alga before you caught it.

The water runs off in the direction in which the alga was floating, and the feeling of sea-rhythm is preserved. Otherwise, you have a stiff, botanical looking specimen, not much like the Master Designer's work.

Two Chlorophyceae; the larger is a pale, clear green, and is transparent.

The amateur collector is mainly concerned with the rhythmic beauty of the seaweed, wishing to preserve it for his own happiness and the enjoyment of his intimate circle, knowing it for its loveliness, and not worrying about where the scientists may put it in debatable classification.

For those seeking texts that will aid in identification, two of the best will be found to be *An Introduction to the Algae* by V. S. Chapman, published by Macmillan; and *Algae, The Grass of Many Waters* by L. H. Tiffany, published by C. C. Thomas.

Now, we'll assume, you have the specimen on the card. You should also have ready, beside the pile of unglazed white cardboard mounts of medium smooth finish, a pile of white gauze squares of the same size, and one of white blotting paper. First, the gauze goes gently on, over the card, specimen and all. Then the blotting paper goes over that, then another mount and specimen, and so on, for a half dozen or so. Then you put a weight on top and leave it alone. The room will begin at once to have a pleasantly clean smell of iodine. Your family may come in and say "phew!", but you know it is pleasant.

The odor verifies what you have heard about the quantity of iodine in seaweed, and recalls how the Portuguese women boil it and put the juice in fresh water and get their iodine, or how northern people get it by eating dulse.

The only attention required while the specimens dry and begin to adhere to the cards by their own mucilage, is the changing of the blotting paper three times a day for two or three days.

Leave the gauze absolutely untouched. When the mount and the specimen are both thoroughly dry, take the weight off, and carefully remove the gauze. You have begun a collection! Maybe, later—if you live long enough—you can learn to name them all, but at any rate the world for you is richer than ever because you have found seaweeds.

On our travels about the country it is the planting that makes—

Highways to Remember

By ANDREW S. WING

Garden Editor, Nature Magazine

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ALONG THE HUTCHINSON RIVER PARKWAY

The beauty of the parkway system in Westchester County, New York, offers a goal for all highway planners. The planting along these parkways, and the tasteful planning of necessary utilities, make this system of highways something to remember.

ONE REMEMBERS motor trips by the roads he travels. It is rarely that the distant scenery is so impressive that the traveler is oblivious to the immediate roadside. We all know routes that are so beautiful that we never tire of them; and we also cannot forget other highways whose environs are blots on the face of an otherwise beautiful countryside. What is there about these highways that makes them fair or foul? In nine cases out of ten it is the roadside planting, plus absence of signs, that makes the difference.

Of course you have to have a good road to begin with. Engineering comes first, although in some states and counties the landscape men are being allowed to have an important voice as to the routes chosen when a new highway is being cut through. Engineers like efficiency. They prefer straight lines, and if that straight line goes right through a majestic old oak tree the tree must come down. So the engineer and the landscape should be given a chance to make a compromise between beauty and economy.

There are few highways in the United States that are built for the future, or even for the present emergency. They are often too narrow, not adequately graded or banked at the turns. They are cluttered up with grade crossings, red lights, blind curves, bad bridges and other impediments to rapid transit. They may be all right for passenger and truck traffic that does not move more than forty miles an hour, but are utterly inadequate for military roads or peacetime express highways. One is impressed by this fact when driving over such rare examples of modern highway building as the Pennsylvania Turnpike, where the turns are banked for sixty miles an hour, and the only bottlenecks are the two-lane tunnels through the Allegheny Mountains. The future will see equally good or better super-highways crossing the continent from east to west and from north to south—not a few but many. We should have them right now.

Admitting that engineering comes first, what is there that we can do with the roads we have to make them more civilized, more worthy of the beautiful country that is ours?

We can protect them from the encroachments of commercial interests. A start has been made in that direction, but more needs to be done to blast the blight of billboards and hot-dog shanties. Perhaps the current rubber shortage, which has already resulted in a decreased highway traffic that will continue to decrease, will be a disguised blessing. It will starve out some interests that have caused so much highway uglification.

We need not, however, wait for that. There is much that we can do now, right in our own communities, to foster highway beautification. Even if all our roads were perfect from an engineering and a traffic standpoint, even if there were not a single drink emporium, snipe sign or billboard along any of our public roads, there would still be much need for planting. A bare bank or a treeless straightaway across the prairie can be ugly of itself. Many communities, counties and states are giving attention to this planting problem and with splendid results.

Every week-day I drive to work from my home in Riverside, Connecticut, to Pleasantville in upper Westchester County, New York. The seventeen miles of this route cover about every good, bad and indifferent type of highway we have in this region. First over a private lane, lined with wild things and Japanese honeysuckle; next over the Boston Post Road, badly blighted but not the worst stretch in New England; then back through an estate section of Greenwich and Westchester, crossing en route the junction

point of the Hutchinson River and Merritt Parkways. Here one can pause and watch traffic hurrying to and from Boston and New York over as fine an express parkway as we have in these parts. Then on up King Street past the manicured estates of merchant princes and publishers, with intervening bits of still unspoiled farm land to the junction of Route 120 at Rye Lake, as fine a bit of scenery as we have in the reservoir section of lower New York state.

Last but not least, the ride over a winding relic of ox-cart days over Bear Ridge to the village of Pleasantville.

CONTRAST IN RURAL HIGHWAYS

Above is a deep cut to make the roadbed of a highway in the Pisgah National Forest, North Carolina. It will be planted to control the banks and eventually become like the road at the right in the Cherokee National Forest, Tennessee. These banks are naturalized with staked weed mulches. In handling our highways engineers and landscape specialists must work together to protect the roadbed from its environs and finally to make highways to remember. U. S. Forest Service photographs.

This last couple of miles is really the pleasantest, in spite of the narrow, pock-marked macadam. In spring, when the old apple orchards are in bloom, when dogwoods crown every hill, and the shadbush lights up the woodlands, this bit of highway is a joy indeed. This is largely a native planting, except for a fine old row of larch trees. The banks of the road at a narrow cut are lined with wild columbine, devil's paint brush, bracken and other sweet wild things. Once a buck deer caused me to stop the car at this point. Let us hope that there will always be wild, bumpy roads like this, with native plantings undisturbed by highway workers, and where the nature of the roadbed is such that one has to drive slowly enough to see the gifts that Nature has planted for us.

We need to preserve the character of these side roads, or to restore to them the character that they may have lost due to the too zealous and undiscriminating hacking and mowing of the highway gangs—official highwaymen! An armistice on mowing for a season or two would develop a lot of desirable material along these roads. Even some of the rarer things such as orchids and fringed gentians might come back, to say nothing of dogwoods, birches, elms, oaks and red cedars in this part of the world. In the farming sections of other states no doubt some of the native flowers would return—sunflowers and Kansas gay feather, to name but two. Highway workers can be trained to leave desirable plants and to take out the weeds. They will need a little coaching at first, but it is not much trouble for a supervisor, or an interested resident, to go through and mark the plant material to be saved. This is being done now in Connecticut and some other states. Along the Merritt Highway in Connecticut, machine mowers leave strips of snowy oxeye daisies, to be mown later after they are through blooming.

Good farmers dislike weedy fence rows, but a little local agitation might persuade them that it is worth while to leave a few trees and some of the vines and herbaceous material growing along their roadsides for beauty and as shelter for game and other birds. Wild grapes, Virginia creeper, clematis and bittersweet will come back if given half a chance; so will goldenrod, wild asters, elecampane,

BRONX RIVER PARKWAY
The tastefully-designed gasoline stations merge into the landscape and serve the public just as well as the sign-bedecked blights seen along most of our highway routes.

and many other interesting and beautiful native flowering plants and grasses. Garden escapes and field introductions are not to be scorned either. What is the matter with the clover family, for instance, or chicory? The latter is a weed, of course, but it does no harm along the roadside and it does provide the most heavenly blue of any common plant. Even the mullein can be handsome, and is cultivated in European gardens.

Noxious weeds must be subdued but a little shade and competition with some of the desirable grasses, herbs, flowers and shrubs will help to keep their population down. Nature has her own way of balancing plant life if given half a chance.

Some actual planting will be necessary, of course, on most roads except those in the remoter, rural regions. And even there the improved roads will necessitate considerable restoration to cover up construction grades and scars. Banks are always a problem and are difficult to keep from slipping unless given the right slope to begin with. It has been found that when new these banks may be held fairly well by driving in stakes and then covering them with grass, hay or straw until vegetation has had a chance to establish itself. Almost any tenacious, creeping plant is good for such slopes. German irises have been used effectively in many places. In New England and in other eastern states the old fashioned tawny day lily (*Hemerocallis*) has been encouraged to inhabit the roadsides. There is no tougher garden flower than this, and it spreads rapidly by division. It will grow in almost any soil and is not seriously harmed by mowing, or even by being burned over. A combination of rambler roses and honeysuckle is an old favorite.

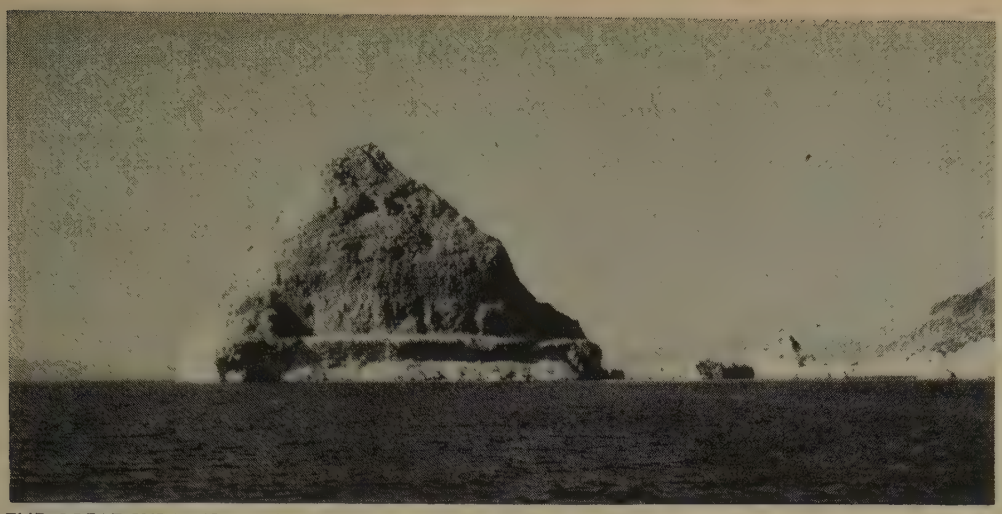
I would like to enter a plea for the planting of more flowering trees along our highways—even where there are already tall shade trees growing on the right of way. Dogwoods are ideal for roadside use. A good many communities in a number of states are planting dogwoods, and one never tires of this gem of American trees. Almost as decorative and equally interesting are the native hawthorns, flowering plums and crabs. In fact I rate the flowering crab above the famous Japanese (now Korean) cherries.

The native things are always sure and appropriate. Many Connecticut highways are being beautified by plantings of mountain laurel, the state flower, while both laurel and wild azalea are included in Westchester, New York, Parkway plantings. These flowering trees and shrubs are usually more effective when used in naturalistic groups, than when staggered at regular intervals down the turnpike. This is one of the secrets of successful highway landscaping—to plant the appropriate thing at the right place. If the land is low and swampy, willows are a natural choice; while both the tall and prostrate junipers thrive on a dry hillside. Not only do plants look more at home when chosen according to their natural likes and dislikes, for soil and drainage, but are much more likely to thrive.

Specific trees are associated with certain states and regions. Elms and sugar maples are symbols of rock-ribbed New England just as live-oaks and palms typify states farther south. But there are other trees that have not been so widely used in roadside and village plantings that might well be more widely planted. Some are the white birch, beech, pin oak, sweet gum, spruce and pines, where they are indigenous. I would like to see more buckeyes and sycamores used in such states as Ohio and Indiana, and cottonwoods in the prairie states. In Texas, where they have been planting firethorn, *Pyracantha,* along the highways, pecans and other native nut trees might be added. With so many diseases coming in, it is well to vary the plantings so that if one species is wiped out by a fungus disease, or made unsightly by insect attacks, there will be other trees to take its place.

Nothing has been said so far about the concerted efforts of such communities as Lancaster, Pennsylvania, to line their highways with plantings of climbing roses, crepe myrtle and others. These community efforts are to be lauded and encouraged. Nothing is quite so indicative of community spirit and morale as the successful culmination of a roadside planting enterprise. There should be more.

As these lines are written Arbor Day is being celebrated throughout the country. We need Arbor Day and what it stands for more than ever before in our history. We need trees that bear food—fruit and nuts—and we need trees for beauty and shade and to replace those that are being sawed into timber for war needs. A good many of those trees should be growing in our public lands today, and there are millions of acres of available land in our roadsides. Why not start planting and beautifying them now?



THE GREAT PYRAMID IN THE SOUTHERN PART OF THE LAKE

When the waters of this lake disappear, this natural monolith will stand in desolate grandeur, rising several hundred feet above the alkaline sands.

Pyramid Lake, mere remnant of an ancient inland sea, is now a—

Lake of Doom

By MARIE LOMAS

BETWEEN the Nightingale Range and the Virginia Mountains, at the southern edge of Nevada's Smoke Creek Desert, lies Pyramid Lake, one of the strangest of the world's desert lakes. Into this thirty-two-mile lake flows the turbulent Truckee River, after rushing down the Sierra slopes from Lake Tahoe. There is no outlet, yet the lake is rapidly disappearing. As the waters recede salinity increases. Soon, scientists tell us, the time will come when the vast lake bed will be only an alkaline sink, a shimmering expanse of salt and sand, completely devoid of every living thing.

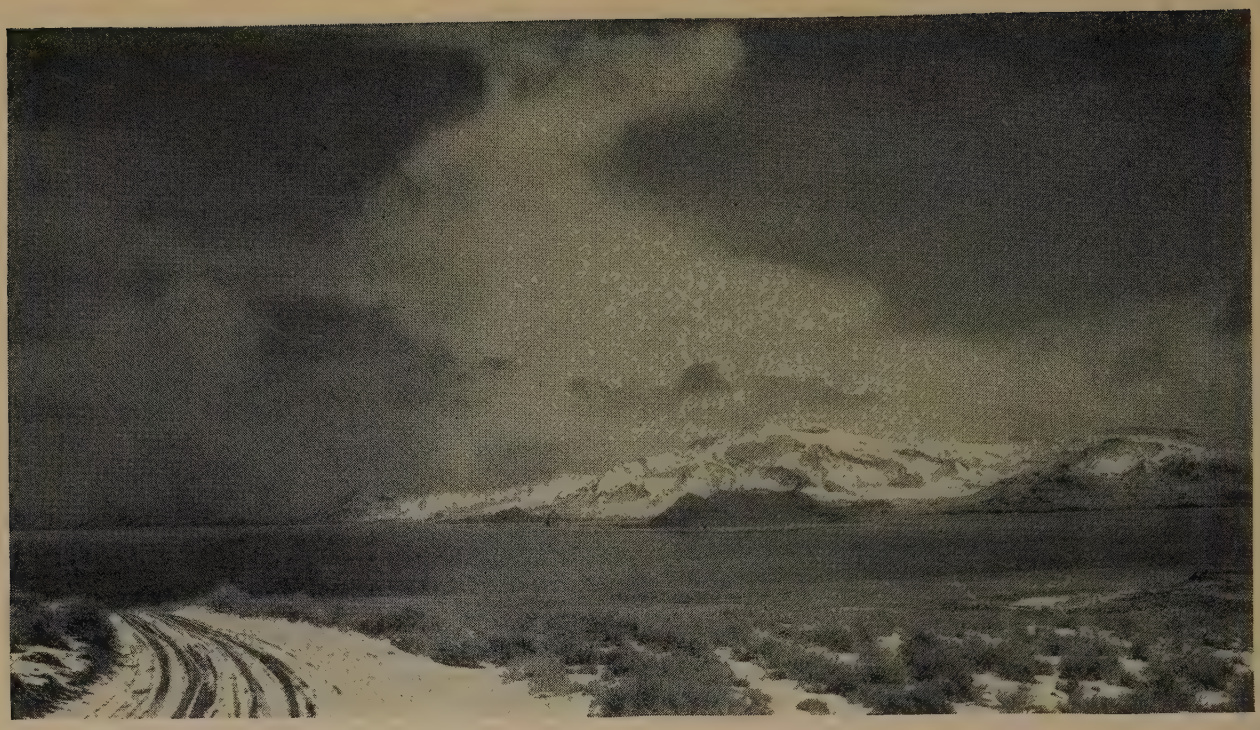
The key to the mystery of the disappearing lake of the desert is found in the weird, fantastic formations: the great white pyramid that, today, rises to a height of more than four hundred feet above the surface of the deep, blue water; the silent, inscrutable sphinx, known to the Indians as the Stone Woman, or the Squaw and Basket, which keeps an age-old vigil on an almost inaccessible shore; the cathedral-like Spires and Pinnacles, which dot a mile-long promontory; the stark-white ribbon of minute algae, five hundred feet above the present shoreline. This is the tell-tale beach of not so many years ago. In a strange mixture of beauty and tragedy, all these reflect the inescapable doom of Pyramid Lake.

That this land-locked lake is a mere remnant of an ancient inland sea is evident from the reconnaissance reports and maps of the conspicuous terraces and beaches high on the surrounding mountains, made by the United States Geological Survey. But of vital importance today are the more recent water-lines now seen near the base of the Great Pyramid, along the blanket and basket of the Stone Woman, and on the hundreds of pinnacles. They indicate the beginning of a far more rapid recession, due not only to climatic changes but to man's harnessing of Nature—the diversion of part of the water from the Truckee River to the Lahontan Reservoir and to the irrigation ditches of the Paiute Indian Reservation.

THE SQUAW WITH A BASKET

Indian legend holds that, blanket-wrapped, the woman was doomed to sit thus for some offense against the gods.

Actually the strange story of Pyramid Lake goes back



LOOKING ACROSS PYRAMID LAKE IN WINTER

The Great Pyramid may be seen at the left of the black formation, which is the Anaho Island pelican rookery. The doom of the lake spells also the doom of the rookery.

only a few years, as geological time is measured; back only to the beginning of this present age, when the glaciers withdrew and left what scientists term an inland sea extending over what is now northwestern Nevada, northeastern California and southeastern Oregon. At that time its area was somewhat larger than Lake Ontario, or approximately 8900 square miles. Preliminary reports of explorations by engineers of the War Department, and reports of the Geological Survey, designate this body of water as Lake Lahontan. It is probable that Lake Lahontan, like its residual, Pyramid Lake, had no outlet and thus was subject to rapid evaporation. The sharply-cut terraces and inclined beaches of Lake Lahontan remain as perfect in contour and as regular in slope as if formed only a few years ago. Erosion has been slight due to the fact that the deposits are porous and absorb rain, allowing it to penetrate far into the soil. Without moisture, freezing and thawing through the years has had little effect.

While there are areas to the north and east of the old lake shore said to be still unexplored by white men, many points may easily be reached by motor and without a guide. Near Desert Mountain and on the slopes of Painted Mesa are terraces showing horizontal stratification composed of gravels and huge boulders from the adjacent mountains. Not far from Carson City the exposed terrace contains plant remains and occasional fresh-water shells. In Plateau Valley, between Dayton and Carson City, can be seen stratified clays and coarse gravels at a height of several hundred feet above the surrounding country.

That Lake Lahontan may have been in existence as late as the beginning of the Christian era, or later, seems probable. Spear heads of chipped obsidian have been found in Lahontan sediment, and in Lovelock Cave, situated on the old Lahontan shore, many objects of primitive man have been excavated. Crude household articles, hunting equipment, including cleverly fashioned duck decoys, bone

THE PINNACLES

The cathedral-like spires dot a mile-long, rugged promontory.

fish hooks, wearing apparel of skins and feathers of birds, even human mummies, have been unearthed, all identified as belonging to the Basketmaker period. All fossils from this same sediment, too, belong to living species.

Probably the most spectacular evidence of the vanishing lake, however, is to be found in the formations at Pyramid Lake. Opinions differ as to the process that shaped the Great Pyramid itself. Some believe it to be of volcanic origin, since steam and hot water spout from jets near the base of the monolith. According to Indian legend the pyramid was placed over an erring woman, and, although she was turned to stone, her breath still pours forth to scald any who venture too closely to the spot that harbors her spirit. The Squaw and Basket, too, the Indians claim, is one of a tribe noted for its arts and crafts, but she was condemned to a sphinx-like pose encased in a stone blanket and left holding her largest basket, for some forgotten offense that incurred the wrath of the gods.

In the pinnacles far to the north, on the rugged cape projecting out into the water, a more scientific explanation of the formations is evident. These spires or "needles", as they are sometimes called, range from small tubular chimneys still below the water line to the ghostly castles towering as much as three hundred feet above the promontory. All are of tufa, a grayish-white deposit of calcium carbonate.

The lacustral growths now below the surface, and a few along the shore, are still in the process of formation. When the hot water of countless submerged springs comes in contact with the colder and more dense water of the lake, carbonate of lime is built up, mushroom-like, with openings at the top through which water and steam continue to issue. The higher growths that form the back-drop of this weird stage-setting of Nature have been left behind as the lake receded.

While ancient Lake Lahontan at its maximum covered more than 8900 square miles, the present residual lake has an area of little more than 325 square miles. In a survey made only sixty years ago, an area of 828 square miles was recorded, more than twice the area of the lake of today.

Fish still live at the north end of Pyramid Lake, but at the south end, where the Truckee River enters, the water is brackish, too saline for fish or for human use. As in a vicious circle, the lake's evaporation leaves its alkaline deposit and the Truckee gathers it again into solution to return it to the lake, hastening the day when the large trout, the cormorants, the pelicans and even the sagebrush along the shores, will have vanished forever.

In an effort to conserve the vital food supply of the Indians on the reservation surrounding the lake, the government recently built a dam on the Truckee River, but only climatic changes, over which man has no control, can save the lake from its dismal fate. The ultimate end will be a saturated solution and a lifeless sink, with the Great Pyramid, several hundred feet higher than the Pyramid of Cheops in Egypt's Valley of the Kings, standing in desolate grandeur on the burning alkaline sands.

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The Large Bellwort

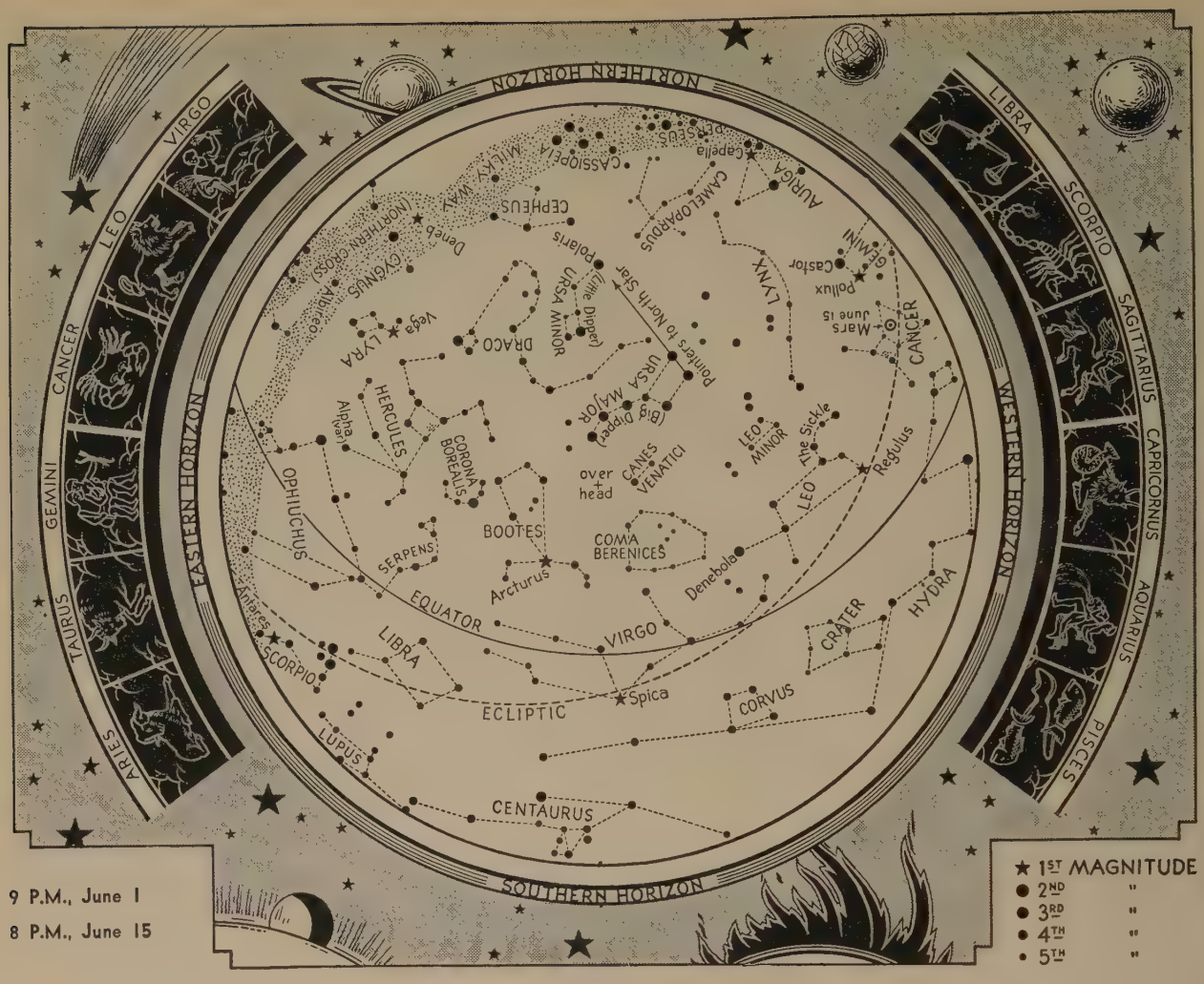
An early wildflower of the woodlands of the north

By WARREN C. WILSON

THE large bellwort, *Uvularia grandiflora,* as its name indicates, has the largest flowers of our northeastern bellworts. It is also called wild oats by some. The blossoms, produced in April or May, are a light tannish-yellow and hang gracefully from the tips of the forked stem. The light green leaves, which are whitish beneath, are classified as a perfoliate type; that is, the stem apparently passes through the blade near its base. The plants commonly reach eighteen inches in height.

The large bellwort is a native of the rich organic soils of interior woodlands. It ranges from New Hampshire to Minnesota and south to Kansas and Tennessee, but it is absent or rare on the coastal plain. You will find that it makes an attractive plant and is easily grown in your wild flower garden.

Although superficially *Uvularia grandiflora* does not look like a lily, it belongs to the family Liliaceae. The generic name, *Uvularia,* is "from the flowers hanging like the *uvula,* or palate" according to Gray's Manual.



To use this map hold it before you in a vertical position and turn it until the direction of the compass that you wish to face is at the bottom. Then below the center of the map, which is the point overhead, will be seen the constellations visible in that part of the heavens. It will not be necessary to turn the map if the direction faced is south.

A Heavenly "What-is-it?"

By ISABEL M. LEWIS

THERE IS a small body near the earth that has been playing hide and seek with the astronomers for more than a month, and it looks very much as if this tiny object, whether asteroid or comet is not certain, might eventually make its escape from the telescopic net without anyone knowing what it is, where it came from, or where it is going.

News of the first observations of this object came in a round-about way. To the Central Bureau of Information of the International Astronomical Union, which has always been a clearing house for astronomical news abroad, came a message from Dr. Y. Vaisala of Tartu, Finland, to the effect that he had discovered a small, rapidly-moving object of the 13th magnitude, stellar in appearance. Two positions were given that showed that on March 12-13 it was near the western boundary of the constellation of Virgo, crossing the celestial equator and headed northward. Prof. Stromgren of the Copenhagen Observatory transmitted the message to Prof. Lundmark of Lund, Sweden, who in turn informed the Harvard College Observatory of the discovery by radiogram. The Harvard Observatory, acting as a clearing house for astronomical news and telegrams in this country, sent out to observatories and interested observers an announcement card giving the news of the discovery and observed positions. Although five observations in all were obtained they were discordant in value and the difficulties of the search increased.

Three good observations of position of an object are necessary to obtain what is known as a "search ephemeris" by means of which the object is located roughly after computation of an approximate orbit. This enables observers to train their telescopes on the approximate position and attempt to pick up the object. If the search is successful an accurate determination of the body's position is made and then usually communicated by telegram to the Harvard Observatory. After several positions of this sort have been

received it is customary to issue another announcement card giving these positions of the object on different dates which are often only a few hours or a day or so apart. If these positions are not obtained the object is very likely to be lost if it is faint and rapidly moving, for to observe such an object with a large telescope, which generally has a small field of observation, is a difficult matter. When good observations are communicated those who are skilled in orbit computation generally get busy at once and after several hours of work produce the elements of the orbit. These will show when the body will pass perihelion, or the point in its orbit nearest the sun, whether it is moving in an ellipse, in which case it will return after a definite period which can be given, or in a parabola, in which case it makes but one trip around the sun. Its positions in right ascension and declination in the heavens can then be given for a period of some days or weeks. The size of the orbit can also be given and the date of its nearest approach to both the earth and the sun.

The object is then, as we might say, under control. It can be picked up in the telescope at any time, if not too faint or distant, and its course and behavior followed. It is generally possible to determine at an early stage in the observations whether the orbit is that of an asteroid or comet, even if the physical position of the object does not indicate at once which it is. The Vaisala object was reported by its discoverer to be stellar, which would imply it was an asteroid, although a later observer reported it to be rather blurred in appearance, which might mean it was a small, or very distant, comet that had not developed a tail.

Evidently the Vaisala object has the astronomers guessing as to its exact nature. A preliminary search ephemeris has just been given on a Harvard Announcement Card which was computed at the Students' Observatory at Berkeley, California, where under the direction of Prof. Crawford much skill has been developed in handling such difficult cases. According to the data this tiny body is now in the constellation of Canes Venatici, or The Hunting Dogs, and within about one million miles of the earth. If this is so it is a most exceptional object. Two observations made at the Lowell Observatory at Flagstaff, Arizona, on March 18-19 showed that it was then in Leo and that the images on the photographic negatives were not stellar but had the appearance of comet trails. These observations were made with a 13-inch search telescope and a 9-inch Schmidt telescope.

Few objects, with the exception of the moon, which is approximately 240,000 miles from the earth, come as close to the earth as one million miles. The noted little asteroid Eros, so valuable because it gives us one of the best determinations of the distance of the sun is, at its least possible distance, about 13,840,000 miles from the earth. Three other asteroids (Continued on page 333)

THE SCHOOL PAGE ★★★

EDITED BY DR. E. LAURENCE PALMER

Professor of Rural Education, Cornell University, and Director of Nature Education, The American Nature Association

Fun for Fern Fans

One of the commonest questions asked in botany examinations for college entrance some years ago used to deal with outlining the life history of the fern. It was assumed that ability to answer this question properly might be taken as ample evidence that the person involved had the necessary culture, intellectual ability, and mastery of knowledge to be entitled to the privileges that go with admission to college, or that this knowledge contributed to these qualities in the student. The disturbing part of this whole thing is that many who were able to answer this question glibly, and to record drawings similar to those in Bergen's "Foundations" probably would not have known one fern from another had they met them in the open, and worse yet would have had no desire whatever to know anything more about ferns at any time in their lives. If the learning of the typical life history discouraged one from knowing more about ferns, then the author of this article contends that the requirement defeated the very purpose for which it may have been designed.

The insert in the center of this issue of Nature Magazine is not designed to help anyone get into college, although it may very well be of value in that connection. Rather, it is written with the thought that its readers may want to use, appreciate, and recognize, and help others use, appreciate, and recognize, more of the common ferns than they otherwise could. It was not possible to include drawings and text material of all ferns to be found throughout the territory in which our readers live, and everyone is advised to consult his own state museum, state college, or state conservation department, to learn if there is not more suitable local literature available. An excellent little book on the ferns of Wisconsin has come to the writer's attention since the insert was prepared, and there are no doubt many others.

While ferns may be studied in school during the regular year, since they are in evidence at any time of the year to those who would seek them, they are probably at their best in the summer months. Summer camps and summer schools, then, should find the insert useful if the work is designed to help students understand important parts of the outdoor scene in the current season.

Ferns are so varied in their morphology and physiologic requirements that the more you study them the more you will be interested. If you are not particularly interested in simply naming ferns, make studies such as these suggested in your camp or summer school class.

Make a practice of holding a piece of fern frond compactly between the palms of your hands for a few minutes and then seeing how they vary in the effect on them of the heat from your hands. Some ferns will curl and shrivel while others will change little.

If you must pluck ferns be careful not to destroy the whole plant or to tear the parts hidden underground. Remove small portions of different ferns and notice how they vary in their ability to withstand ordinary drying. Of course, if you are entering seriously on the making of a botanical collection, select specimens that will show the distinctive characters, but even then refrain always from taking the last individual in a stand of plants. A good practice to remember is always to leave at least three plants untouched in a radius of three feet. Species that are especially rare locally should be spared all disturbance.

If you are interested in similar variations, try putting fragments of fern fronds of various kinds in the freezing compartment of an electric refrigerator to see how the different kinds are able to resist freezing. Some will be found to be highly sensitive while others can withstand freezing with few conspicuous changes resulting.

Try submerging parts of different kinds of fern fronds in salt water to see if they are equally resistant to the effects of salt, and, if you wish to vary this, try other chemicals in solution in a similar way.

If you have the collecting instinct and yet feel that you do not wish to destroy any fern plants, set out to make collections that will show variations, let us say, in the fruiting parts only. Make another collection showing portions of sterile fronds and then learn to recognize a species by either the sterile or by the fertile parts, if this is possible. Read in the insert section, or elsewhere, about how ferns may cross or hybridize and then see if you cannot find ferns that have the characters ascribed by the books to more than one species. You cannot say that a mule is either a horse or a donkey. By the same token you cannot say that some ferns are of only one species.

If the teacher is of the type who must teach about dinosaurs and about conditions that existed on the earth long ago, then at least the ferns should be studied as evidence of the antiquity of life on the earth. They and their relatives held a prominent place on the surface of the earth long before many of our present-day plants came into existence.

To the writer, one of the most interesting variations to be found in the ferns centers around the manners in which their fronds develop. The crosier-like "fiddle-heads," which are so obvious in such a common house fern as the "Boston fern" are not conspicuous in all ferns. What variations can you find in frond development in the ferns of your region this summer?

Experiment with the available ferns to see which of them produce a fiber of superior quality, either in the parts above ground or in those underground. If the ferns are abundant, try making cordage for emergency use with the underground runners of brake. Are there any ferns of the region that excel this fern in this respect?

Collect mature fertile fronds of a variety of species of ferns. Dry them between sheets of white paper and see how many of them produce spores in sufficient abundance to leave a spore print on the paper against which they were pressed. Make a collection of the fertile fronds of such a fern as the sensitive fern that will show fresh fertile fronds of the current year, those of last year, and those of as many previous years as are available. Is it possible to get spores shaken from these older fronds, and if this is so, what advantage to the plant exists in its ability to produce spores at any time of the year over a span of years? What protection, if any, is there in the various ferns for the fertile parts which produce the spores?

Make lists of the kinds of trees, shrubs and herbs found growing within a yard of each kind of fern you know. Let this list develop until you have a list of "fern neighbors" that remains relatively constant. With this list of associates in mind, it should be relatively easy for you to learn to predict what ferns may be found in an area partly by the presence or absence of larger, more conspicuous, plants. Dr. Wherry's *Guide to Eastern Ferns,* listed in the insert, gives some excellent data regarding the soil requirements of different ferns that are significant in influencing the kinds of plants to be found associated with them. This book is well worth reading even by those who do not live in the East because it gives in considerable detail the techniques whereby botanists are able to cross different species of ferns under laboratory conditions. Most of these methods are so simple that they may appeal to some of our better high school students if not to the more dilettante layman.

Many Nature students who seek hobbies in which they may become specialists without too much difficulty are advised to work with groups that are not too abundantly represented. For example, amateurs are advised to work with the club mosses rather than with the mosses or with the birches rather than with the thorn-apples. This is good advice. Applied to the ferns, it might be well to recommend that some hobby rider may care to make collections of insects associated with ferns, of conspicuous injury caused to ferns by fungi, and of galls on ferns caused by any organism whatever. For the most part, ferns seem to be so free from gall injury, from insect pests, and from conspicuous fungal parasites that their presence will prove to be the exception rather than the rule. It would probably be a simpler task to identify and list the insects found living on most of the ferns of your neighborhood than to do the same for a single apple tree in your side yard.

It would seem that the most fun for fern fans comes not from experimenting with the plants to see what "makes them tick", but with getting to know them so well in their natural setting that they appear like old friends whenever they appear along the path. Even though it necessitates getting my feet wet I rarely go on two particular trips near my home without stopping to climb a couple of ledges just to look at and possibly to touch some walking fern and a tiny spleenwort. To my knowledge I have never collected a plant from either of these ledges though I have visited the ferns on one of them periodically for over thirty years. These ledges are in a gorge where one of our large native species of clematis grows. I have never been able to get to the clematis but I can enjoy it with my field glasses from a pinnacle on the opposite side of the gorge. I wish that others might get as much fun from just seeing ferns in their natural setting as I do. They make up a part of the picture of the out of doors which I hope will not vanish or diminish.

SEVEN SINEWS OF STRATEGY

(Continued from page 294)

the processes are not yet in actual production. That will be the next step, and may have been taken by the time this article is in print.

It may well happen that there will be a shortage of steel for an indefinite period due to increased consumption of present manganese stocks. But remember that American inventive genius, especially in evolving new methods for extracting metals from low-grade ores, did not die when Poland was invaded. It actually woke to new life and greatly increased vigor. And within two or three years, this same genius will undoubtedly give us all the manganese we need.

Mercury, the "lively silver" of the ancients and the only metal that is liquid at ordinary temperatures, is absolutely vital in manufacturing explosives. Many scientific and research instruments depend upon mercury's peculiar properties, and an enormous amount of the metal is also used for drugs, paints and disinfectants.

Most people think of Spain as the chief source of our supply, but due to the demands of the first World War there are now about sixty mercury mines in California alone. Deposits of cinnabar—mercury ore—in Texas, Nevada and Oregon are also being worked, and to such good purpose that of late years we have actually been able to export some of the metal. Apparently, then, we will not lack for mercury as we did back in 1917, so do not be in a hurry about scrapping your thermometer for victory.

Nickel was one of the earliest metals used to alloy with steel. It is a necessary partner with chromium in making both armor plate and stainless steel. Not only that, but nickel-chromium steels are a vital part of all vehicles used for transportation. The most intensive search of our country has failed to reveal any but the most negligible deposits of this strategic metal. Yet, strangely enough, American metallurgists are not worrying much over the nickel supply. This is because ninety percent of the world's entire known supply of nickel lies some fifty miles north of Lake Huron in a patch of land forty miles long and fifteen miles wide. There, near Sudbury, Ontario, the International Nickel Company operates the famous Creighton mine. Of course, this mine must supply the needs of Canada, England and the United States, but stepped-up production can undoubtedly take care of all war demands. We may, of course, have to do without nickel-plated gadgets, but some substitute may be found to take the place of that particular use of nickel. Moreover, since Canada is our closest friend, metallurgists feel safe on the score of nickel.

Tin is greatly under-valued by the average citizen even though he encounters daily the miracle of the tin can. Some five thousand years ago, ancient metal workers learned how to combine ten percent of this silvery metal with ninety percent of copper, to get bronze. And it was from bronze—not iron—that those men forged the key that opened the door to our modern civilization. Tin has always been a strategic metal. Two thousand years ago, Caesar invaded Britain to insure having a reliable source of tin for bronze armor and weapons. Today, however, the Cornish tin mines produce only about two percent of the world's supply.

Tin is even more a strategic metal now than then. All means of transportation—automobiles, street cars, trains, airplanes, steamships—are dependent on tin since it is an important component of the best bearing alloys. And, naturally, there could be no bronze for ship fittings without tin. An ordinary automobile takes about ten pounds of this metal; a modern ocean liner, something like seventeen tons.

Actually, tin is a semi-precious metal. Commercially pure tin costs more than a thousand dollars a ton—and since tin is practically as heavy as steel, a ton means only about *four cubic feet* of the metal.

Of the hundred thousand tons of tin we have been using each year, nine-tenths have been coming from the Pacific Ocean areas already lost to us. The first answer to our tin problem is, obviously, no more tin cans, because we have been using one-third of our tin each year for cans and food coverings. This order is already in effect. Not using tin that we cannot get, however, will not give us any more of it.

We will have to find other sources—and we are doing it. The ingenuity of metallurgists has been directed in a number of directions. For instance, we have been increasing our efforts to reclaim tin from plated objects to such good effect that we now have something like a hundred thousand tons of this metal in our stock piles. Then there has been established in Texas City, Texas, a three and one-half million dollar refinery for treating tin ores shipped from Bolivia, as there are good tin mines in that country.

Metallurgists are also busy experimenting with tin-less bearing metals, and are also trying to substitute silver for tin in solders. They are meeting with more than fair success in both directions. As for cans to hold food, manufacturers have been working on a number of different ideas. Right now, it seems quite possible that we will see the familiar *steel* can coated with some sort of a lacquer instead of tin, for tin cans are actually made by coating steel with a thin film of tin.

Try as we may, there seems to be little hope that we can produce the entire one hundred thousand tons of tin a year, if we continue to need that much. Substitution appears to be the answer.

Tungsten is the last metal of the strategic seven. We all know tungsten. You see it everywhere as the filament inside electric lights. But more important than this, tungsten is an indispensable factor in modern mass production. Through the genius of Eli Whitney the United States gave the *process* of mass production to the world as long ago as 1798. However, it was an English metallurgist who originated the tools that made modern mass production possible. His name was Robert Mushet. In 1868, Mushet alloyed manganese and tungsten with plain steel and obtained a tool material that was much better for machining steel than ordinary carbon tool steel. In 1898, two Americans—Fred Taylor and Maunsel White—worked out an alloy steel containing about eighteen percent tungsten and four percent chromium. They also learned how to heat-treat tools made from this metal, making them so hard that they cut other steels like butter. In days before tungsten steels, a cutting tool that would shave off a thin streamer of steel at a rate of thirty feet per minute was tops. Tungsten steel tools will machine off thicker shavings ten times faster. No wonder metallurgists call it "high-speed steel". This greatly increased speed of machining metals has made mass production possible. Therefore, at a time when, for victory, more metals must be machined at higher speeds than ever before, tungsten is of vital importance.

Compared to tungsten's importance, the amount used per year seems ridiculously small—about four or five thousand tons. Practically all of this has been coming from China, with small offerings from Argentina, Mexico, Bolivia and Peru. Our supply from China may be made entirely unavailable before this article appears in print.

The picture, however, is not all black. We have discovered considerable low-grade tungsten ore deposits in several western states. These have been worked to a small extent for several years and now will be pushed strongly. That, in addition to our reserve stock pile, which is good for half a year, plus a ton or so from Mexico, Argentina and Bolivia, will hold us for some time.

But this is not all the story. There is a still-little-known element we may be hearing a lot about during the next few years. It is molybdenum, a metal that is like tungsten, only more so. Metallurgists can make high-speed steels for tools by adding about eight percent of molybdenum to steel, along with one percent of tungsten. In the past there have been certain technical difficulties to doing this, but now they appear to be completely licked. Tests on an extensive scale have proved that molybdenum steel tools are excellent, and they may soon take their place alongside tungsten steel tools in our mass production picture. There is no need to fear that our supply of *molybdenum* will run out. There is an entire mountain of high grade molybdenum ore in Colorado. It is such a huge deposit that it contains ninety-five percent of the world's known supply of this metal.

As for the critical metals—platinum, vanadium and titanium—we will not have to worry too much about them. Platinum for scientific instruments, and vanadium and titanium for alloy steels, can be obtained in sufficient quantities for war production.

The United States is especially powerful in the essential metals, of which we need huge amounts. These are iron, copper, lead, zinc and, of course, aluminum. Despite all the furore and strife that has risen around this light, white metal, the United States has excellent resources of the bauxite ore from which aluminum is refined. In addition, a far-sighted industry during the past decade or so drew supplies of bauxite from the mines in northern South America. Our own have been more or less untouched. And American genius has again re-asserted itself in the form of a recently perfected process for extracting aluminum from alunite, a heretofore useless aluminum ore. Large quantities of alunite are found in Utah, Nevada and Colorado. The extraction method, worked out by the Bureau of Mines, promises to give us plenty of aluminum for war work. It does *not* guarantee that there will be enough left over for pots and pans.

Another metal that Germany has popularized to such an extent that many Americans have become needlessly worried is magnesium. Magnesium alloys are nearly as strong, and even lighter, than aluminum alloys. Germany, unable to get enough aluminum until she took over the immensely rich bauxite beds in southern France, went in heavily for magnesium and perfected a number of good aircraft alloys.

Until quite recently, our supply of magnesium metal, which was used mainly for flares and tracer bullets, came from the Michigan brine wells. But when the government

started adding more and more magnesium alloy parts to every new type of airplane to lighten the machine, a plant was established in Freeport, Texas, to extract magnesium from sea water. This plant is now in full scale operation, and with the inexhaustible sea to draw from, there is little likelihood that we will run short of magnesium.

Another little-known metal that is becoming rapidly more important is beryllium. Beryllium is lighter and far harder and stiffer than either aluminum or magnesium. Two percent of beryllium in copper produces an alloy that is as hard and strong as high-grade alloy steel. Tools made from beryllium-copper do not give off sparks when struck, a point that is essential to a man's life when he is working around explosives or gasoline. Moreover, beryllium-copper springs will outlast the best steel springs many times. The peculiar properties of this new alloy have already made it indispensable for more than one hundred small parts in modern bombers and transport planes. Although there is plenty of beryllium in the earth's crust—and most of that in the western half of the world—the pure metal is still expensive. This is due to the small amounts handled. Still, there is no fear that we will not have enough for the present, or even for its increased uses in the future.

All in all, it seems that Nature did a better job of stocking our land with metals than we are apt to realize. Of course, we will be called upon to make many sacrifices, because we still lack certain metals. We will also have to give up other things temporarily until industry can readjust itself to new mining and processing methods and new sources of supply. That much is certain.

But there is something else that is just as certain—perhaps even more so. Metallurgically, our nation will emerge from this war far stronger and more self-sufficient than was thought possible a few years ago. There will be many new ore deposits uncovered. New and cheaper methods for refining the ores will be worked out. There will be new alloys developed. Old alloys will be greatly improved.

American inventive genius is not dead! And American metallurgists will play an important part in making the post-war world a better, a richer, and a safer place in which to live.

WOULD *YOU* STARVE?

(Continued from page 297)

scraped, sliced and boiled with potatoes and onion, turn the whole mixture a delightful pinkish color. The psoralea, commonly known as "bread-root" and "prairie potato", is turnipy in taste and may be baked in hot ashes just as one does potatoes. Bulbs of all species of wild onion make good flavorings for meats and soups, or may be eaten raw as a relish or fried. Salsify has escaped from cultivation to grow in fields and waste places, and is now quite common everywhere. Its roots are an excellent basis for a nourishing soup.

Wild fruits and berries abound throughout America. Most of these are edible; some are especially delicious. A few, such as the baneberry, are poisonous and should be avoided.

Wild cherries, service or "sarvis" berries, buffalo berry, choke cherry, berries of the false solomon's seal, twisted stalk and bunchberry, currants, gooseberries, raspberries, huckleberries, blueberries, bilberries, grapes, ground cherry, and the "prickly pears" of the cactus, are all fruits extensively used by the Indians, eaten raw, made into sauces, or dried and stored for winter use. The strawberry was found too juicy to dry for winter, but was enjoyed during its season.

The berries of the bearberry, or kinnikinnick, were cooked with meat as a seasoning for the broth. When fully ripe, berries of the nightshade were boiled, ground, and mixed with chile and salt to be eaten as a condiment with mush or bread. The green fruit was, and is, considered poisonous. Berries of the Oregon or holly grape, *Berberis,* were bruised, sweetened, and mixed with water to make a pleasant drink. Rose hips and the tiny apples of the hawthorn have furnished the Indian food.

Of these many fruits the camper or hunter will find most appetizing when raw the raspberry, strawberry, wild grape, huckleberry, and blueberry. The others can be kept in mind for the "very hungry" stage, or can be carried home for the making of sauces and jellies.

A few nut-bearing trees are found in various parts of the country. In the Rockies we have only one of any consequence, the hazelnut. Acorns were much used by the Indians, and after having had the tannic acid leached from their meats, were added to soups, imparting a creamy texture. Pulverized nut meats, to which water had been added, substituted for cream in the Indian dietary.

One need not starve with this wealth of native food material at hand. But there is one final warning: have some knowledge of plants before eating them. Such knowledge is not hard to come by; the flora of every section is adequately described and illustrated in popular, simply-treated manuals. An excellent bulletin on Indian food plants is published by the United States Department of Agriculture. In this way can be avoided the dangers of the water hemlock, the roots of which could be confused with those of *Carum;* the death camas, sometimes fatally mistaken for the true camas; the roots of pokeweed and aconite, the seeds of the Jimson weed, *Datura,* the attractive red, but harmful berries of the baneberry, and others having poisonous properties.

RECIPES

Cattail Flapjacks

Two cups cattail pollen and 2 cups flour; 4 teaspoons baking powder; 1 teaspoon salt; 2 eggs, or 2 tablespoons egg powder; ½ cup evaporated milk; 1½ cups water; 1 tablespoon sugar or maple syrup; bacon drippings.

Beat eggs, add milk, water and maple syrup. Mix and add dry ingredients, beating until mixture is creamy. Add melted bacon drippings. Fry in a hot greased pan over a camp fire. Makes about 20 cakes.

Spatterdock Mush

Prepare the pond-lily seeds by breaking the large pods open in a bucket of water and separating the seeds from the sticky pulp by washing. Spread out in the sun to dry. Cover the bottom of a frying pan with the dried seeds and hold over a slow fire, shaking the pan and stirring the seeds about, much as is done in popping corn, thus parching them. A coarse meal is then made by grinding the parched seeds with flat stones.

Bring to a boil four cups of water to which a pinch of salt has been added. Stir in one cup of the meal. Boil briskly for about fifteen minutes, stirring constantly, then set far enough from the blaze that it will not scorch, and cook slowly for nearly an hour. Stir the mixture occasionally, and if it seems to be getting too dry, add boiling water to thin. Serve hot with raspberries or blueberries and cream and sugar.

If any of the porridge is left, pour into a greased pan, let cool, then slice and fry in butter or bacon drippings for the evening meal. Serve with syrup, jelly or honey.

Milkweed, Rice and Tomatoes

Gather the milkweed pods when they are no longer than an inch or an inch and a half. At this time the entire mass is tender, rich and juicy, very like the popular okra. Wash thoroughly, as dust clings readily to their fuzzy surfaces. Cut off the tips and slice, examining each pod carefully for insects.

Over a regulated fire, bring to a boil two vessels of water. To one add a pinch of salt, and in this cook one cup of rice. In the other gently boil one quart of the milkweed slices until tender or for about half an hour, adding salt when nearly done. Carefully skim off the scum which rises while simmering.

Drain the rice, add two tablespoons of butter or bacon drippings, salt, pepper and paprika to taste. If desired, one or two small wild onions may also be used for seasoning. When the milkweed is tender, drain, add the tomatoes and rice. Allow to simmer over a slow fire for a few minutes longer, then serve hot.

This, together with a dish of wild strawberries and a hot drink, will make a wholesome meal in itself, or if served with planked fish, will be particularly appetizing.

Soup With Milkweed

Boil beef or ham until it pulls away from the bone, together with milkweed pods, cut lengthwise into small pieces, several small wild onions, and a handful of rice, lima beans or barley. About an hour before serving, add a can of tomatoes, salt, pepper, and a little cayenne to taste.

Fireweed Greens

Boil the smaller, young leaves of fireweed, which have been carefully washed, until tender. Fry a few slices of bacon, diced. Drain the water from the greens; pour into the frying pan with the diced bacon and drippings. Beat two eggs and add. Allow to simmer for about five minutes, or until the egg has set.

A Duck and Wapatoo Imu

If duck is not available, use a leg of lamb or a chicken. Wrap the meat in large leaves, such as rhubarb or those of the arrowhead. Wash the arrowhead, or wapatoo, roots.

Dig a pit, somewhat longer and deeper than needed for the meat. Line this with round stones as large as your fist, and build a hot fire on them. Keep the fire burning hotly for two or three hours, adding another layer or two of stones and more fuel as needed. When the stones are white hot, scrape out the embers, line the pit with a thick layer of grass or leaves, set the leaf-wrapped meat in place and surround with the washed arrowhead roots and any other vegetables you may have. Cover with more leaves and grass, then a wet burlap sack and finally with warm earth from about the pit. After an hour, or two hours, depending on the size of the imu lay, the pit may be opened and the meal served hot.

VERNON BAILEY PASSES

Vernon Orlando Bailey, one of America's foremost naturalists, and well known to thousands of our readers, died at his home in Washington, D. C., on April 20, 1942. It is particularly fitting that our Association should mourn his passing, for he was co-author, with his wife, of the leading article in Nature Magazine's first number, published in January, 1923. This joint authorship was symbolic of the Bailey household, for their married life of more than forty years has been an object lesson worthy of a pair whose entire lives have been governed by the principle of "working together", and working for others, whether in natural-history studies, or in any field—social, educational, or humane—that called for cooperative effort. Mr. Bailey was on our board of scientific consultants from the first.

Vernon Bailey was born of pioneer parents on June 21, 1864, in Manchester, Michigan. When about six years old he went with his parents to Elk River, Minnesota, and here he grew up, happily engaged on the farm, and always with his eyes open to the ever-changing happenings of Nature. The birds of that region were already pretty well known, but the study of North American mammals was then just well begun. This condition was largely due to the difficulty of capturing specimens of small species. Some of these hibernate during the colder season, and many others live most of their lives underground, venturing abroad only during the hours of darkness. Even the ablest naturalists had seen only those that accident had thrown in their way. So to capture these elusive creatures young Bailey made tiny traps, modeled after the box traps that he set for rabbits. With these he soon captured species that not even the Indians knew, and these, sent to Washington for identification, brought recognition from Dr. C. Hart Merriam, who had just founded the government office that was to become the Biological Survey. Soon the young man was a member of Merriam's small force, and from then on Bailey's rise to prominence in the service was merely a matter of time.

Those who wish to learn of Bailey's honors and accomplishments may consult *Who's Who*. With little academic instruction, but rich in educational accomplishments gained in the "School of the Woods", he became one of our best all-round naturalists.

Mr. Bailey married in 1899 Florence A. Merriam, the sister of his friend, Dr. Merriam, and herself accomplished as a student and a writer, who already had several books on outdoor subjects to her credit. As has been intimated, the forty years they have spent together has seen the production of hundreds of published items in the field of Nature, many under joint authorship. On several occasions Mrs. Bailey, when unable to accompany her husband on long trips, visited some place favorable for Nature study, and later placed her observations on record, usually in one of the more prominent ornithological magazines.

Vernon Bailey was, perhaps, best known as a mammalogist, but he was also a practical ornithologist of the outdoor type, and had a field knowledge of the plants of the country that many a botanist might well envy. His knowledge of the geography of the West was, I believe, unsurpassed. There have been few years, during the past five decades, that did not find him traveling, by some method, through desert, forest, mountain trail, or river valley. His memory of places visited was the most exact that I have ever known. He added to a genius akin to that of the Indian for memory of topographic details the broad geographic viewpoint of the cultivated scholar. With all these various fields of interest, advanced by a tireless energy, Vernon Bailey has accomplished much. He had no need for the time-consuming amusements that so many crave, for with his interest and enthusiasm in all Nature's products, including his fellow-man, he was always busy, and all his work was play. E. A. P.

PEROGNATHUS

(Continued from page 298)

has been so, in fact, ever since I found him curled up sound asleep in the bright morning sun safely caught in the trap. He lets himself be handled and examined without showing the slightest concern or fear. I have never heard him make a sound—vocally, that is. All night long, however, he rolls stones about his cage, drags his food bowl from corner to corner, and quite makes up for his speechlessness. When placed on the floor or on a table he cautiously feels out every inch of new ground, but when the lay of the land is familiar he scurries about taking short, quick jumps in every direction. On the few occasions when he has had some loose dirt to explore he hurriedly digs a shallow hole and proceeds to take a dust bath, rolling in it like a colt in a paddock.

In their wild state the pocket mice, as well as the other small nocturnal mammals, must be ever on the alert for such enemies as the silent and needle-taloned owls, snakes, coyotes, cacomistles and badgers. But in spite of such numerous, varied and deadly dangers these mice are quite common over most of their range. They are essentially burrowing rodents and often numbers of them will make their tiny burrow-homes in close proximity. All in all, whether as a pet or as a hunting and hunted member of our nocturnal fauna, acquaintance with a pocket mouse is an experience hard to equal.

Prose and Poetry

Red Hills. By Marel Brown. Nashville, Tennessee. 1941. Broadman Press. $1.00.

It is a pleasure to call to the attention of our readers this charming little book by one who has appeared in the pages of *Nature Magazine* as a poet. In this volume she mixes sentient verse with poetic prose into a fine literary confection of which "An American's Prayer," written before Pearl Harbor, is an example:

God, make me worthy of this day,
  This house, abundant food, my work, my play,
The safety of these hills, each busy street,
  And friendliness of neighbors as we meet.
For freedom to enjoy outspoken thought
  Make my heart yearn to thank Thee as I ought.
For birds that soar unharmed though planeless skies,
  For rest, and lack of fear in children's eyes,
For wide horizons without angered foe—
  Help me to manifest the love I owe.
While bombs are ploughing England's cherished sod,
  Make me deserve America, O God.

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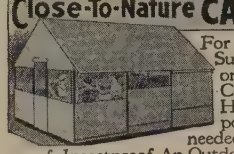

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TO THE EDITOR

Counting Bird Visits

Dear Sir:

In the April issue of *Nature Magazine* appears a very interesting description of a gadget for counting the number of visits made by a pair of wrens to a house to feed their young . . .

This article called to mind some data I had collected on the same subject, not by means of an electric-eye, however, but by direct observation. I have seen a pair of wrens make from twenty to as high as forty-two trips in one hour. Each time they brought some insect to feed the young. Raymond F. Yates records an average of only forty-seven trips daily, which would be but about 3 an hour with sixteen hours of daylight in June, or only 4 trips an hour on a twelve hour basis.

It might be interesting to hear of other observations that have been made on this subject.

OSCAR E. ROESELER
Superior, Wisconsin

Red Face Department

Dear Sir:

On page 176 of *Nature Magazine* for April, 1942 is a picture of a giant cactus with the statement that there is a National Monument to it in Utah. The only reservation of these I know of is the Papago Saguaro National Monument near Tucson, Arizona. Is there really one in Utah also, or is this a misprint?

HENRY VISBECK, JR.
Butler, N. J.

We apologize to Mr. Visbeck, all our other readers, and the State of Arizona. We knew better, of course, but it was just one of those things that sometimes get by.

Fag Bags

Dear Sir:

It occurred to me that possibly you might be interested in the fact that we have received numerous responses to Nature Magazine's mention of our need for fag bag material. Indeed, one high school in Chicago has undertaken the making of the bags themselves as a result of your message in our behalf. It is only natural that we should be deeply grateful for such generous support in the important forest protection campaign now under way.

WILLIAM V. MENDENHALL
Los Angeles, Cal.

Hitch Hiker

Dear Sir:

The other day while out for a stroll I noticed a dragon fly (snake feeders we used to call them) darting along as usual, but evidently under a handicap and going so slowly that I could see it quite distinctly. And lo! a brownish, fuzzy caterpillar had fallen from a tree (so I suppose) and, of all places, had happened to land on the back of this dragon fly. The presence of its undesired guest evidently handicapped the flying of the dragon fly, for, while it did continue its darting, the motions were obviously quite labored and the wing membranes on one side were apparently disturbed or broken. The caterpillar, in the meantime, was lifting its head and looking about as if wondering where and when to cast off. Both host and guest, so it seemed to me, would have been quite willing to discontinue their forced relationship, but neither knew what to do.

I did not have the chance to see the end, however, for the dragon fly at last veered over somewhere and I lost sight of him and his curious burden.

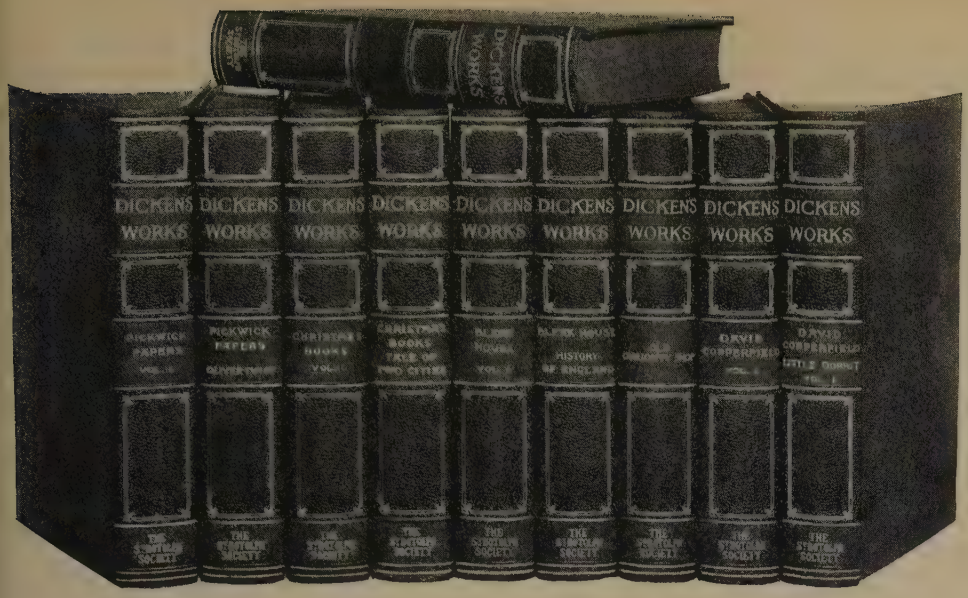
PAUL GRISWOLD HUSTON
Jacksonville, Florida

Tree Topping

"Wholesale tree topping is reaching epidemic proportions in our section of the country," writes H. Wyatt Washington from Huntington, West Virginia, sending the above picture of decapitated oaks as a graphic case history of the disease. Whether this is regarded as progress or arises from ignorance, he says he does not know, but he is certain that it is contagious. Mr. Washington adds that earlier assaults by the tree butchers' axes have been directed at maple and elms, but the devastation pictured here is of ancient but healthy oaks.

Ring Around the Rosy

"Ring around the rosy" is a lot of fun if you are playing on the lawn, but if the ring around your roses consists of thousands of little green aphids, the result is not going to be so good. Aphids can literally destroy vegetation of various kinds, including roses, by sucking the sap from the plant and by scarring or poisoning the tissues. Each aphid has a bill which he inserts into the tender green plant tissue and sucks the sap out, just like a mosquito draws blood from your body. Aphids are not killed by spraying stomach poisons on the plant, because the bill goes right through into the plant. A contact spray, like Black Leaf 40, that kills when it hits the insect, is the effective way to control aphids.



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NATURE IN PRINT

As a convenience to readers the books reviewed in the pages of Nature Magazine may be ordered through the book department of the American Nature Association, 1214 16th St., Washington, D. C.

(Continued from page 287)

recreational reading, and yet it contains many myths that beguile the reader as effectively as Grimm or Andersen, and is throughout written with clarity for the layman. Mr. Finnie's work has primarily an informative purpose, but it accomplishes this with the style of a feature article writer and carries a similar appeal to the reader. The rest of these books are ideal for recreational reading, and prominent among their interests are accounts of wild creatures.

In his own preface William Beebe provides the best characterization of his *Book of Bays:* "We interrupted unnamed beings," he writes, "at their meals five hundred fathoms down in the black Pacific, we interfered with hosts of others near shore from sea-elephants to eels, sea-snakes to baby sailfish. We exposed exciting lives by turning over heavy stones (and often, in compassion, heaved them back again). We clambered up cliffs to interview infant boobies, and slithered through the unreal world of mangroves after rare crabs, and held binoculars poised until our arms ached. The froth of the trip is in these chapters; the technical meat is served up in scientific courses elsewhere."

Earnest A. Hooton in an introduction to *The House in the Rain Forest* performs a similar service for me. "Mrs. Crockett's book," he declares, and faithfully in my opinion, "is jammed with good descriptive writing, excellent anthropology, and real humor. I am appalled by the catholicity of her interest in and fondness for the animal kingdom. She had pets all the way from cockroaches to cockatoos. Perhaps that is why she even extends her zoological interest to that most pestiferous of all animals—man."

Needle to the North I must describe solely on my own responsibility as the most striking and satisfying record of an expedition that has been written in a long time. The successful quest that it describes for specimens of an unknown seal and the survey made of the wildlife of the Belcher Islands are in themselves subjects for vivid writing opportunities that are not overlooked. Yet the romance of travel by land, air, and water in a region "guarded," as the book says, "by wind, snow, and natural violence of every sort;" the living arrangements that the scientists were able to make; and the people with whom they shared their sub-Arctic months make *Needle to the North* a volume that should be most popular and in many cases read and re-read. How much we may owe to the collaborator Nigel Herrick I do not know, but certainly the always moving continuity of the narrative and the manner in which its characters come to life on its pages are tributes not only to the actions, findings, and observations of the explorers but also to the re-creative skill of the writers. If there were a Pulitzer prize for books on explorations I would nominate *Needle to the North.*

A word should be added regarding the excellent photographs that are included in these books. Perhaps more of our feeling of familiarity with distant lands and other peoples is due to our excellent photographers than we have realized.

Adventures in Nature

Byways to Adventure. By Edwin Way Teale. New York. 1942. Dodd, Mead and Co. 222 pages. Illustrated. $2.75.

This is a timely, excellent and different book. Its subtitle is "A Guide to Nature Hobbies". It is timely because it packs between its covers a wealth of source information on how to pursue Nature hobbies at a time when we must return to simpler and more fundamental things in life. It is excellent because the author has carefully covered the field and amassed an amazing amount of reference material. It is different because it has never been done before as completely and broadly as here. In addition to all these assets, Mr. Teale's book stimulates an enthusiasm for the development of Nature hobbies, and provides a vast amount of information of general interest and importance. The author's own pictures are an asset, as well.

Canadian Flowers

Wild Flowers of the Prairie Provinces. By Elizabeth Burnett Flock. Regina, Saskatchewan. 1942. School Aids and Textbook Publishing Company. 112 pages. Illustrated. $.75.

Covering more than two hundred of the common wild flowers of the prairie provinces of Canada, this is an excellent little popular guide useful to the plant lover, both juvenile and adult. The descriptive text is simple and is supplemented by appropriate line drawings by the author's husband.

Meet the Prairie Dog

Prairie Dog Town. By M. T. Raymond and C. O. Mohr. New York. 1942. Dodd, Mead and Company. 56 pages. Illustrated. $1.50.

This is a charming little story, written for the younger audience, of one of the most interesting of rodents. The busy life and organization of a prairie dog village is fascinating to the observer, and it includes or attracts other forms of wild life beside its main residents. There are many attractive illustrations.

About the Dachshund

The Dachshund. By Grayce Greenburg. Chicago. 1942. Judy Publishing Company. 160 pages. Illustrated. $2.50.

This is a new and revised edition of a book about one of the most ingratiating of dogs. A favorite for thirty years before World War I, he was the victim of hysteria during that period along with sauerkraut, Goethe, Schiller and Wagner. Since then he has won more hearts and, we trust, has proved himself a most loyal naturalized American.

Conservation Booklets

My Land and Your Land Conservation Series. Published by the National Wildlife Federation, 1212 Sixteenth Street, Washington, D. C. Four books. Two of 32 pages; two of 48 pages. Illustrated in color and black and white. Fifty cents a copy, with lower prices for quantity orders.

These four books are designed to provide basic conservation information for school children from the third to the eighth grade levels. The first book, *Would You Like to Have Lived When —?,* is prepared for the third to fifth grades and is written by Miss Mary Melrose and Dr. Paul E. Kambly. It presents a picture of early America, of the wealth of wildlife, water and fertile soil found by the pioneers, and a brief view of what has happened to these resources. This last consideration is further explored in *Raindrops and Muddy Rivers,* which is designed for the fourth to sixth grades. It is written by Miss Melrose and Dr. Kambly in collaboration with Dr. Charles W. Quaintance and Dr. Orra E. Underhill. Soil erosion and its terrific drain on our soil resources, together with its pollution of streams, are the major concern of this second booklet.

Slanted for grades five to seven, the third booklet is *Plants and Animals Live Together.* In this the authors, Miss Melrose and Dr. Kambly, sketch generally the interrelationships between our plant and animal life and the impact of man upon the balance of Nature that this relationship represents. The fourth book, in the authorship of which Dr. Raymond E. Janssen joins Miss Melrose, Dr. Underhill and Dr. Kambly, is entitled *Nature's Bank—The Soil* and is prepared for the sixth to eighth grades. As the title suggests, it is concerned with that fundamental resource, the soil, upon the permanence and fertility of which all depends.

These four books present a necessarily very general picture of conservation, but do so in a way that should be extremely valuable in providing background material for the earlier school levels. We should imagine that the fourth book would fit admirably into its proper niche in the social science courses now given in most junior high schools. The earlier books will be helpful in the grade schools in the science work and introduce a conservation thought that is too often absent at this grade level. We cannot estimate the usefulness of these booklets to teachers—although as a layman we do not see how they could fail to be useful—but hope that our Director of Nature Education, Dr. E. Laurence Palmer, will endeavor to evaluate them in a forthcoming School Page. R. W. W.

For Busy Gardeners

Garden Easily! By H. K. Morse. New York. 1942. Charles Scribner's Sons. 208 pages. Illustrated. $2.50.

This book is predicated on the conviction that the pressure of wartime is going to leave less time available than previously for the tender care of the garden; that greater efficiency and short cuts will be necessary if gardeners are to make their proper contribution to victory, and have a garden also. So, in this volume, Mrs. Morse discusses the flowers that will work with the gardener rather than those that require coddling and special attention. While especially appropriate to these days, it would seem that this discussion would be valuable to the busy gardener at any time.

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A HEAVENLY "WHAT-IS-IT?"

(Continued from page 325)

—Adonis, Apollo, and Amor—in parts of their orbits come much closer to the earth than Eros. The first of these has become notable from the fact that it comes closer to the earth than any other known planetary object. In 1932, the year of its discovery, it came within 6½ million miles of the earth. It is noted not only because it comes within the orbit of the earth, but also because its perihelion point lies within the orbit of Venus, and it may at times come within 80,000 miles of that planet.

If the Vaisala object is found to come within a million miles of the earth and is an asteroid it will replace Adonis as the planetary object which comes closest to the earth, and closer than any object except the moon, meteors, and occasionally the tails of comets. If it does prove to be a comet, instead of an asteroid, it will be the first cometary object known to have passed so close to the earth. The absence of a tail or anything to reveal immediately its cometary nature indicates that if it is a comet it must be an extremely small body. If an asteroid it must also be one of the smallest, as it is of only the 13th magnitude, and is not visible in small telescopes.

During the months of June and July Venus will draw nearer to the sun in the morning sky, but will still be a magnificent object far outshining all other stellar objects in the sky. It will rise about two hours before the sun in June. It will be in conjunction with Saturn on July 3. Although Saturn has now passed to the morning sky it will be too close to the sun to be seen until the later part of June. It will improve its position in July, rising in the northeast about three hours before the sun.

As Jupiter will be in conjunction with the sun on June 25, it will be too close to the sun to be seen until toward the end of July, when it will rise about two hours before the sun.

Mercury will be in inferior conjunction with the sun on June 12 but may be seen in the northeastern sky before sunrise at the end of June and, as it reaches its greatest distance west of the sun in the morning sky on July 6, it should be easy to find during the first half of July. It rises about an hour and a half before the sun on the 6th and is about 15 degrees above the horizon at sunrise.

Mars will be the only planet visible in the evening sky in June and July. It is now of the second magnitude and in June will be the most conspicuous object visible in the twilight in the northwestern sky. During July it will fade rapidly in brightness as it draws nearer to the sun and will become increasingly difficult to find.

A shower of meteors known as the Delta Aquarids have their maximum display after midnight on July 28, and for a day or so before and after this date. They are about equal in the number of their falls to the Leonids, which average about 20 hourly. They are much less frequent in appearance, and have a shorter duration than the Perseids, which appear about two weeks later.

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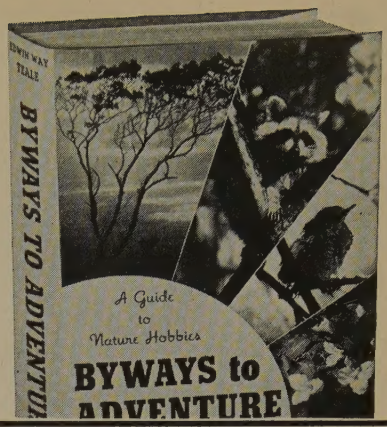

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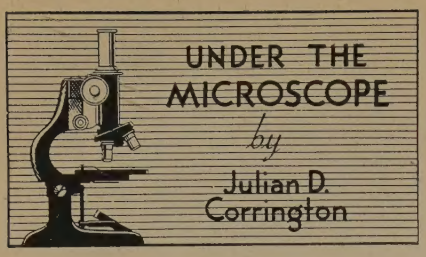


THE HOME LABORATORY

The ultimate goal of the amateur microscopist from the standpoint of physical equipment is a well-organized laboratory in the home. Teachers, students, and technicians in the many scientific fields can avail themselves of institutional rooms and property for their investigations or hobby interests, but the independent worker must cater to his own needs as best he can.

Any space wherein one pursues scientific studies by observation or experiment is a laboratory. The precincts may consist of no more than a table and chair, or they may occupy a corner of a general purpose room, a separate room, or even isolated quarters, as a shed, shop, or other outbuilding. The rural microscopist may prefer the latter, but his urban brother will commonly have to use space in the home or apartment. How much space will depend upon availability and need, and no general rules can be given save that of having an adequate amount, if at all possible.

In the average home a room can usually be finished off with wallboard in either the cellar or attic. The basement is best for year around work and will more often have the necessary utility outlets, but the garret is frequently the only area unoccupied, is cleaner, less subject to noise or interruptions, and may be cool enough in summer, depending on climate and insulation.

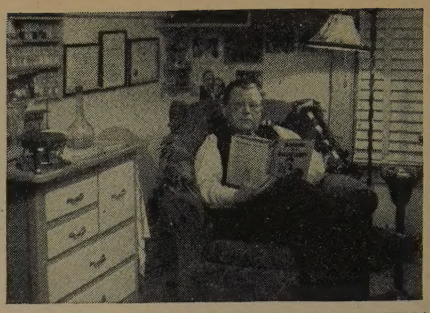
It is possible to use the bathroom, kitchen, or cellar laundry sinks for running water, as in washing tissues, and the kitchen stove for washing or sterilizing glassware or heating chemicals to dissolve them. If these somewhat makeshift operations are necessary, then the laboratory itself need have only electric outlets for general lighting, microscope lamp, and such accessories as a slide dryer, imbedding pot, spreading board or incubator. An alcohol lamp will suffice for the minor heating operations. However, for any considerable amount of serious work, it is best to aim for the ideal of having water, gas, and electricity, most of which can use second-hand fixtures or be installed by the owner if low cost is a feature. In normal times a used sink of small size is neither rare nor expensive, and a single pipe line, for cold water only, with one faucet, is ample. Of the three utilities gas is the least essential, its main employment being for small stoves and Bunsen burners.

Specifications will have to suit the layout available, as to space, outlets, and funds, but in general what might be termed a model disposition would include a study table, placed across a window, with the operator's chair facing the outdoors, a work table along an inside wall, next to the sink, and rows or stacks of shelving or bookcases elsewhere along the walls.

The study table should be flat-topped and have a tier of drawers at each side, the kneehole desk being the most serviceable type. On this is kept the microscope, in its wooden case or under a cloth hood or bell jar to exclude dust; writing materials and chief reference works; a container for clean blank slides and another for cover glasses; magnifiers and dissecting instruments; and other tools one's particular specialties dictate.

The work table is a bench where solutions are made and used and where the many operations of microtechnique are performed. Here will be kept the microtome, scales, oven or incubator, slide dryer, various electrical or gas devices, and perhaps the row of staining jars. These jars may be placed along the rear of the study table and used there, however, if this desk is large enough. Wall shelving or bookcases will provide room for the sets of reagent bottles—stock chemicals, fixing solutions, dry stains, staining solutions, used stains, dehydrators, and mountants, as well as for the slide library, catalogs, and books.

The room should be kept clean and made attractive by displaying aquaria, cultures, plants, and framed drawings, photomicrographs, or portraits of famous scientists. Keep a box of your best slides handy to show friends and visitors when they drop into your laboratory. If you use a microprojector, a small roller curtain or blank white wall space can act as a screen for showing these slides as well as the organisms in a drop from an active culture.



MR. NUSHAWG HIMSELF COMPLETELY SURROUNDED BY THINGS MICROSCOPICAL.

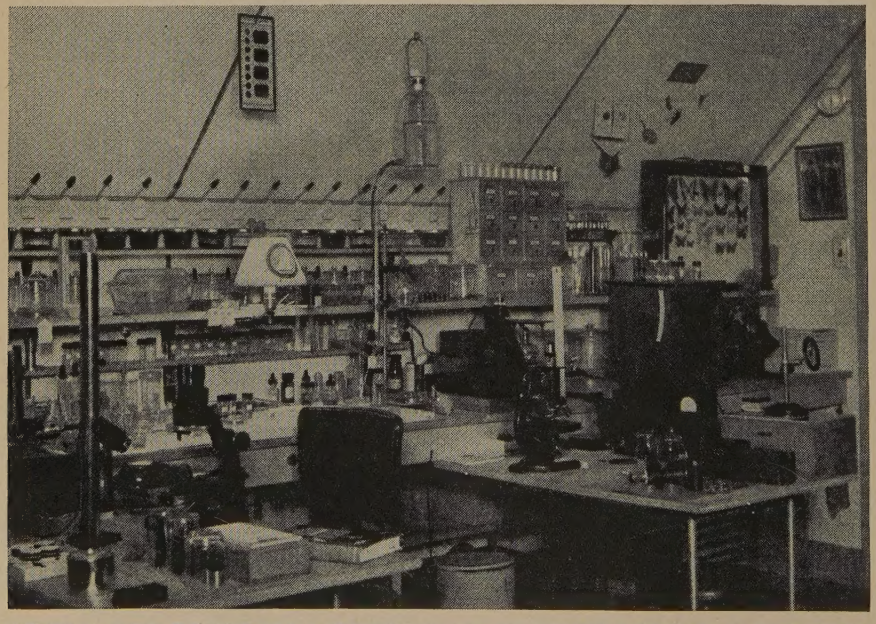
To descend from generalities to the particular, our illustrations show three views of the home laboratory of William N. Nushawg, of 292 Sycamore St., East Aurora, New York, and will prove useful in demonstrating what can be done by the private student, as well as providing a splendid example of utilization of space, systematic arrangement, orderliness, and attractiveness. While the greater proportion of our readers can scarcely hope to achieve such elaborate quarters or equipment, many will undoubtedly find valuable suggestions by a careful study of these pictures.

In the general view note swivel chair between two tables; each table hinged to main bench and with but the two outer legs; left table with camera pillar, spreading board heater, and wide-field binocular microscope; right table with monocular microscope and camera; photomicrographic camera on bench, behind microscope; distilled water delivery bottle suspended from ceiling; top shelf with rows of protozoan cultures, each with separate, labeled pipette above; filing cabinets, reagents, glassware; motion picture projector in corner, below insect collection; containers and storage space under bench and tables fully utilized; everything orderly and labeled.

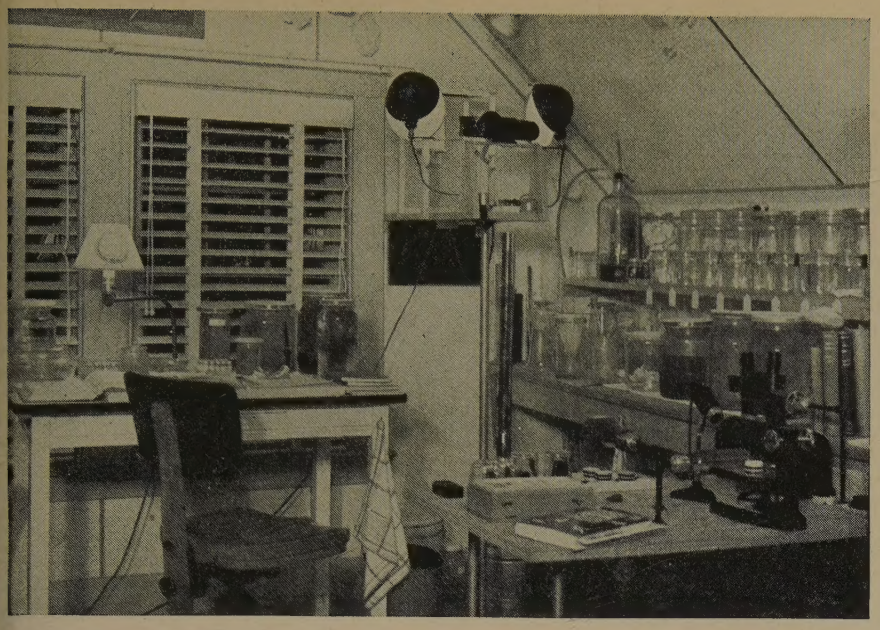
Another photograph shows the left table from the center, looking toward a corner of the room. Here the visitor secs a photocopying apparatus set up, additional cultures, a third work table, reference works, and again the wide-field binocular microscope, with wide-field lamp at left, for vertical illumination, a second lamp for transmitted light, and a third, bull's-eye type, for either reflected or transmitted lighting.

The third illustration brings us to the owner, designer, and builder of these enticing premises, and shows him reclining comfortably, just to the left of the window table in illustration two. The important new feature in furnishings is a stand with drawers, burner, scales and wash bottle; also shelves of stains above stand, diplomas, pictures, more books and, above and behind the lamp, a portable radio. Not shown in any of the three views are other corners, containing an office desk, files, insect collecting materials, fluorescent lamp for minerals, collection of mineral specimens, drawing equipment, typewriter, and many natural history trophies and curios. Cantankerous indeed would be the individual who couldn't enjoy any number of evenings in a room like this!

What sort of a man is he who has had the



GENERAL VIEW OF ONE WALL OF WILLIAM N. NUSHAWG'S PRIVATE LABORATORY.



CORNER TO LEFT OF VIEW IN THE LARGER PICTURE OF THE LAB.

skill and ingenuity to build this scientific oasis for himself? Mr. Nushawg says that it is all "just a hobby—but sure some fun!" He is sales manager for the Cling-Surface Company, Buffalo, manufacturers of transmission belt dressing and leather treatments. He is 45 years of age, is married, and has an adopted son, Noel, age 4. A graduate of the University of Dayton, Mr. Nushawg now finds his chief hobby interest in microscopy, specializing in freshwater biology, protozoa in particular, and the photomicrography of protozoan specimens in Kodachrome. Next in order comes entomology, with the dissecting and slide mounting of insect specimens, and third on the list is mineral collecting and the study of fluorescent specimens. We were naturally highly pleased to read that his education in microscopy was derived mainly from our book, *Adventures With the Microscope*, as well as to note that in his recent portrait he is examining our latest effort, *Working With the Microscope*. He is an enthusiastic member of the American Society of Amateur Microscopists.

"Microscopy plays a very important part in my life," writes Mr. Nushawg, "from the hobby as well as the educational point of view, for who can have a hobby of such interest that he would not want to acquaint himself with the details of the subject matter at hand? Hence my library has grown and grown."

While this laboratory is a shining example of the highest ideals of the amateur microscopist, it is by no means an isolated case, as one might imagine. We have on file numbers of other photographs sent us by readers from Quebec to California, from Chicago to Miami, of beautifully arranged and equipped laboratories, built and maintained by private individuals of all ages and vocations. The most striking case is that of a farm lad who is unable to write a grammatical letter or spell half of his words correctly, and yet who has bought more than five thousand dollars worth of the finest professional equipment with money earned the hard way, and who knows how to use petrographic microscopes, microtomes, and other elaborate instruments. Another is that of an elderly maiden lady who lives alone, surrounded by apparatus that would make the visitor think he was in the research laboratory of a big industrial concern.

The lure of microscopy as an inexhaustible hobby is truly amazing, and one can scarcely credit the extent to which its devotees will go; the painstaking and meticulous labor, the boundless enthusiasm, the unflagging interest. These examples should spur many of us to greater effort. If the will is there, we can all find the time and funds to attain that goal we once set for ourselves.

HISTORICAL OUTLINE

In addition to the great triumvirate of pioneer microscopists—Malpighi, Swammerdam, and Leeuwenhoek—previously discussed, two lesser lights of the period remain for mention.

Robert Hooke, perhaps best described as an experimental philosopher, was born at Freshwater, on the Isle of Wight, in 1635, and died in 1703. Although versatile and gifted, he seemed always destined to play second fiddle and to achieve only the ranks of the near-great and never the great.

At Oxford he was employed as an assistant by Robert Boyle, celebrated father of chemistry, discoverer of Boyle's law (volume of a gas varies inversely with the pressure) and of many other highly important milestones in physics, chemistry, and physiology, and one of the founders of the Royal Society of London (this Department, Aug.-Sept., 1941). Working both together and separately, Boyle and Hooke conducted many thorough investigations on the properties of air, experimenting with air pump, barometer, and vacuum tube, and laying down fundamentals about oxidation and animal respiration one hundred years before the discovery of oxygen. In 1667 Hooke demonstrated before the Royal Society that an animal may be kept alive by blowing a stream of air into the lungs, and hence that it is the air and not movements of the chest that is essential in respiration. King Charles, it is said, had many a hearty laugh over these scientists who had nothing better to do with their time than to spend it in weighing air!

Among the numerous inventions of Hooke were a weather clock, anchor escapement of clocks, spring balance wheel in watches,

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anemometer, screw-divided quadrant, and universal joint. He had correct ideas as to the nature of heat and propagation of light, but did not follow up by proving them experimentally. Before Newton, he guessed the notion of universal gravitation, but lacked sufficient mathematical knowledge to demonstrate his theory. Hooke's law, as found in modern texts of physics, has to do with elasticity and states that the amount of stretching of a wire is directly proportional to the force exerted. It was Hooke, too, who gave us the conclusion that double stars or any two points on a single object must be far enough apart to subtend a visual angle of at least one minute of a circumference if they were to be discerned by the eye as two, and not as a single fused object. This observation, in 1674, is fundamental in studies of the most important factor in microscopy—resolution.

In the biological or microscopical field, however, Hooke is by far best known for his famous publication, the *Micrographia,* in 1665, the first "revelations of the microscope" type of book. The full title may be interesting to those who have not seen an original copy or one of the excellent modern reprints. *Micrographia:* or Some Physiological Descriptions of Minute Bodies made by Magnifying Glasses with Observations and Inquiries thereupon. By R. Hooke, Fellow of the Royal Society, London.

As may be imagined, this volume gave a decided impetus to use of the microscope and is far more important in the development of science for that reason than for any of its contents. Most histories of science or biology figure the microscope used by Hooke (Nature Magazine, Feb., 1939) and all students of biology are acquainted with the fact that Hooke invented the name for units of plant and animal construction when he observed the block-like compartments of dead walls in cork and called them *cells.* For this study, Hooke cut an exceedingly thin slice of cork and thus also invented the method of thin-sectioning.

The *Micrographia* is a miscellaneous collection of observations, with many excellent illustrations, of such things as rocks, textiles, leaves, seeds, hairs, the head of a fly, the flea and louse, point of a needle, edge of a razor, and so on. Here again one cannot but regret for his sake the missed opportunity of exceptional importance. It seems odd, indeed, to a reader today to find that the first book on use of the microscope should contain no studies of pond water or parts of the animal body, no discoveries in microbiology, or no mention of protozoa, hydras, parasitic worms, embryos, histology, or anything new or important on insects! Yet so it was. Hooke could have been a Boyle, Newton, Maxwell, Lavoisier, Malpighi and Leeuwenhoek, all rolled into one, and the seventeenth century would have had a great luminary, equal in brilliance to Aristotle or Leonardo, but he lacked the capacity, concentration and tenacity to follow up his many promising leads. In 1678, when Secretary of the Royal Society, we find him publishing his *Microscopium,* little heard of today, wherein he *verifies* the discovery of bacteria, recently reported to the Society by Leeuwenhoek. Hooke was not well-grounded nor particularly interested in biological subjects.

Nehemiah Grew (1641-1712), English physician, on the contrary, is celebrated for his exhaustive work in a single field—plant anatomy. Unlike the discursive Hooke, or his contemporary Malpighi (this Department, March, 1942), who wrote epochal monographs on a number of different subjects, including plant anatomy, Grew concentrated mainly on the one research project, beginning at the age of twenty-three. *The Anatomy of Vegetables Begun* appeared in 1671 and the more comprehensive and revised *The Anatomy of Plants* in 1682; Malpighi's treatise on plants in 1675. Of the two texts, Grew's is generally considered superior, but as a scientist Malpighi far outshone his less versatile and prolific contemporary.

In Grew's complete work there are more than five hundred engravings, about sixteen percent of which were microscopic studies. Here for the first time appear those three-dimensional drawings of solid objects known as stereograms (incorrectly, stereographs) which today so ably reinforce the printed word in conveying structural ideas of cylindrical parts of animals and plants, as spinal cord, intestine, bone, root, or stem. Those done by Grew showing the histology of stem and root were beautifully executed in large size, requiring a great expenditure of time and labor to fill in each fiber or cell, and are still valid today. As we mentioned in our recent review of a new work, Pool's *Basic Course in Botany,* one of the interesting features is the incorporation of a number of Grew's illustrations. Not many seventeenth century drawings still have teaching value in our times.

At the time of his first publication, Grew was Editor of the *Philosophical Transactions.* Like Malpighi he failed to appreciate the cell as the unit of structure, and so missed this great generalization, thinking the appearance under his lenses due to the interlacing of fibers. He extracted chlorophyll from green leaves, but could not, in his day, realize the chemistry or importance of this substance.

The researches of Malpighi and Grew placed plant histology far in the van of biological studies. Improvement in this field as well as corresponding work with animal structure was not to appear for over one hundred and fifty years.

TRADE NOTES

A small volume with a big message is Kenneth M. Smith's *The Virus, Life's Enemy,* a book that deals with a complex and difficult medical subject in a way understandable by the layman. The sequence is admirably developed, the interest sustained, and the amount of authoritative information digested and summarized is amazing. Here one reads how viruses were discovered and how they are studied, with discussions of the various theories as to their nature. Experimental work on isolation and transmission and the important virus diseases together with methods of prevention and control are all presented. The subject is of paramount importance in modern medical research. When one pauses to consider that yellow fever, smallpox, infantile paralysis, encephalitis, measles, mumps, and the common cold in man; rabies, distemper, foot-and-mouth disease, swine influenza, parrot fever, and fowl plague in animals; and the many mosaics in plants are all virus infections, it is realized that such an assemblage constitutes quite as formidable a problem for science and the future welfare of mankind as either the bacterial or protozoan groups of diseases. The author likewise discusses the possibilities that viruses cause malignant tumors. To keep abreast of present-day medical studies, important to all persons, one should have some knowledge of the virus, life's enemy. The illustrations include some excellent photomicrographs. Pp. viii, 176; frontisp., figs. 19. Cambridge: at the University Press. New York: The Macmillan Company, 60 Fifth Ave., 1941. $2.00.

With the issuing of Vol. V, No. 2, April, 1942, number of *Biology Briefs,* the Denoyer-Geppert Company announces suspension of this house organ for the duration. The three chief articles deal with a program of school health education, a biographical sketch of Florence Nightingale, and notes on the biology of whales. We shall miss this valuable and interesting publication, and look forward to its resumption in better times.

Novel methods of organization and presentation mark the *Introduction to General Zoology* by Nathan Fasten, Professor of Zoology at Oregon State College. Adhering to neither the type nor the principles methods as such, the author divides his work into three parts: the animal organism, types of animals, and the development, adaptations, and relations of animals. In the first part, such topics as living matter, organisms, protoplasm, cells, reproduction, and classification are considered as general background. Type studies commence with the protozoa and progress up the scale to vertebrates, though the attempt is made to permit use of the book by those teachers who wish to begin laboratory work with the locust or frog rather than amœba. The final chapter in this section is a thorough treatment of the frog as a representative vertebrate. In the third part, the germ cells, fertilization, development, tissues, organs—with emphasis on man—distribution, ecology, heredity, eugenics, and evolution are considered, the author being well known for his previous books in these fields especially.

The volume is fully illustrated, with photographs, drawings, and diagrams from a wide variety of sources. There is an adequate bibliography, glossary, and index. Portraits of scientists of the past and present add to the interest of discoveries and theories with which their names are connected. This book is well suited for the year course in college general zoology, as collateral reading, or reference, and for the individual working alone. Pp. viii, 742; figs. 514. Ginn and Co., 70 Fifth Ave., New York City, 1941. $3.75.

The microscope has been used to tell what an animal had for his dinner two hundred million years ago. This "strange as it seems" item would cause no wonderment to a geologist, who would be familiar with those fossilized bits of animal dung termed coprolites. These are well known, for example, in the case of ichthyosaurs and plesiosaurs, large marine reptiles once plentiful in our mid-western shallow seas of the Mesozoic. Coprolites may be thin-sectioned and then analyzed under the microscope, just as any rock section may be studied.

Add to your list of house organs of supply companies, Lab-ORATORY, publication of Schaar and Company, 754 West Lexington St., Chicago, Ill. The January issue includes many brief items and two features, a biographical sketch of Lavoisier, and an article on Laboratories, Priorities, and the War. There is an unusually generous sprinkling of cartoons and humor, and a judicious balance between articles, jokes and advertising.